3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This section of the EIS discusses the resource areas that could potentially be affected by implementation of the Bull Run HCP or the alternatives. It also presents information on the regulatory framework and the affected environment for each resource. The regulatory framework subsection for each resource summarizes the existing regulations in place to address environmental impacts. The affected environment subsection presents the existing environmental conditions for each of the resources in the context of key elements potentially affected by implementation of the Bull Run HCP. Potential impacts to these resource areas are discussed in Section 4.0, Environmental Consequences.

3.2 Land Use

3.2.1 Regulatory Framework

The environmental setting for the evaluation of land use impacts is based on compatibility with existing land uses and consistency with relevant land use plans and policies. The discussion of land use plans and policies (below) serves as the regulatory framework for this resource.

3.2.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities.

3.2.2.1 Existing Land Uses

The Bull Run Watershed encompasses 88,962 acres, including 78,899 acres under Federal (Mt. Hood National Forest and BLM) management, 4,426 acres under City ownership, 595 acres under PGE ownership, and the remaining 5,042 acres under private ownership. For the overall Sandy River Basin, most of the upper basin (outside of the Bull Run Watershed) is Federal land, whereas the lower basin is predominantly privately owned. Approximately 74 percent of the basin is managed by Mt. Hood National forest (approximately 70 percent) and BLM (approximately 4 percent). Private lands account for approximately 23 percent of ownership, and about 3 percent of the basin is owned by the City and other local, state, and regional governmental entities. Figure 3.2-1 shows land ownership throughout the entire Sandy River Basin.

Existing land uses within the Sandy River Basin range from protected wilderness areas at upper elevations in the Mt. Hood National Forest to fast growing urban areas in the lower elevations. The

urban area of the lower basin contains portions of the cities of Troutdale and Gresham. Agricultural areas are used to grow row crops, nursery stock, and berries, and to support livestock.

As shown in Table 3.2-1, forestry is the predominant designated use, representing about 284,140 acres (or 89 percent) of the lands within the Sandy River Basin. This land is managed in accordance with the management plans described below. Agriculture is the second most frequently occurring designated use, representing approximately 15,700 acres (or 5 percent) of the basin, and mostly occurring in the lower reaches of the basin. The remaining lands are designated as rural commercial, rural residential, rural service center, or urban. The majority of rural residential lands are located in Clackamas County.

Table 3.2-1 Composition of designated land use in the Sandy River Basin

Land Use Type	Total Acreage	Percent Cover within Basin (%)
Agriculture	15,702	5
Forestry	284,140	89
Rural (including commercial, residential, and service center)	13,545	4
Urban	6,998	2

Source: Sandy River Basin Partners 2005

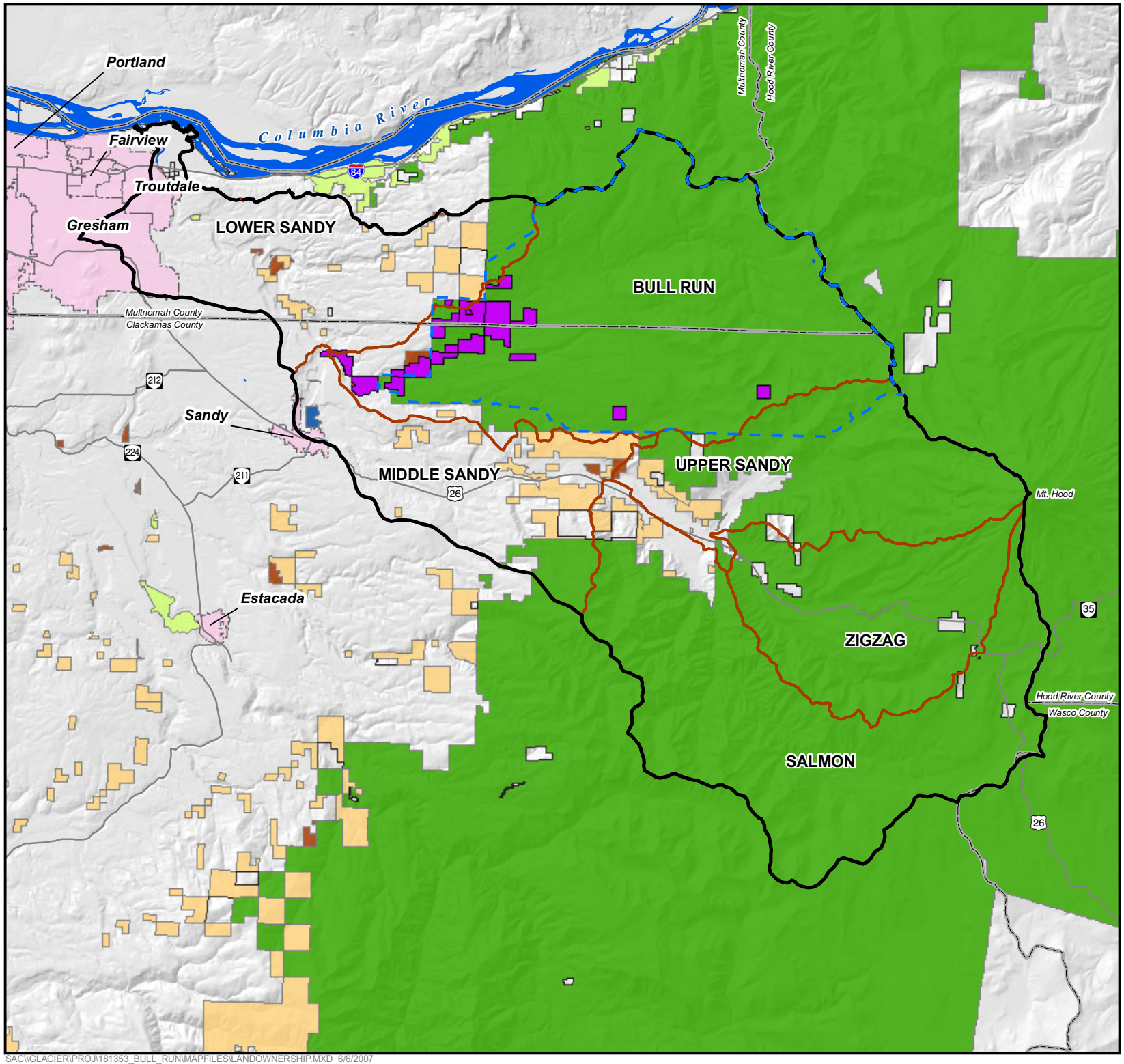
In addition to timber management, urban, and agricultural uses, the Sandy River Basin is used as a water supply source for urban, domestic, and agricultural applications; a power source, and for recreational purposes (recreation is discussed in Subsection 3.12 of this EIS).

3.2.2.2 Land Use Plans and Policies

This section describes the applicable land use plans and policies relevant to the covered activities, including Bull Run protection legislation, Federal management of lands throughout the Sandy River Basin, and various state and local land use plans and policies relevant to activities on private lands.

Bull Run and Little Sandy Watershed Protection Legislation

The Bull Run Reserve was established in 1892. Public Law 95-200 (P.L. 95-200), enacted in 1977, revised the boundary of the federally protected area for the Bull Run River (the Bull Run Management Unit), and required the USFS to develop water quality standards for the basin, and reiterated that the primary purpose of the area was to serve as a source of high quality, raw water for the City of Portland



SAC\\GLACIER\PROJ\181353_BULL_RUN\MAPFILES\LANDOWNERSHIP.MXD 6/6/2007

Figure 3.2-1
Land Ownership
Bull Run HCP EIS

and its wholesale customers. Amendments to P.L. 95-200 were passed by Congress in 1996 and 2001. The Bull Run Management Unit is shown on Figure 3.2-1.

The 1996 Oregon Resource Conservation Act amended P.L. 95-200 and prohibited timber cutting except as needed to protect 1) water quality and quantity, and 2) operation of the City of Portland's water supply and hydropower facilities. The 2001 Little Sandy Protection Act added 2,550 acres of Federal land to the Bull Run Management Unit and extended the watershed protections that apply in the unit to these acres. USFS administers 1,900 of these acres; BLM administers the remaining 650 acres. Most of these acres are in the Little Sandy River Watershed, but a small portion is in the Walker Prairie area, north of the Bull Run River. The Little Sandy Protection Act also provided authorization for appropriations to Clackamas County for watershed restoration.

U.S. Forest Service Land Management

Much of the Bull Run Watershed and other lands in the Sandy River Basin are under Mt. Hood National Forest management. Management activities in the Mt. Hood National Forest are guided by the Northwest Forest Plan (USFS 1994a) and the Mt. Hood National Forest Land and Resource Management Plan (USFS 1990). A reconciliation document drafted in 1995 indicates that all standards and guidelines in the Mt. Hood National Forest Land and Resource Management Plan apply, unless superseded by Northwest Forest Plan standards.

Northwest Forest Plan

The Northwest Forest Plan includes many land use objectives for the protection of terrestrial and aquatic resources on Mt. Hood National Forest lands. The specific objectives relevant to the Bull Run HCP are primarily those of the Aquatic Conservation Strategy. The Northwest Forest Plan outlines an Aquatic Conservation Strategy that contains four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration. Each component is expected to play an important part in improving the health of the region's aquatic ecosystems. The four components are described as follows.

- **Riparian Reserves:** Riparian reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian dependent resources receive primary emphasis. Initial boundary widths for riparian reserves are identified in the Northwest Forest Plan. These widths remain in effect until they are modified following watershed analysis. The Northwest Forest Plan further describes standards and guidelines for riparian reserves, which generally prohibit or regulate activities within the reserves that retard or prevent attainment with the objectives of the Aquatic Conservation Strategy.

- **Key Watersheds:** The Northwest Forest Plan also designates "key watersheds" in two categories: Tier 1 and Tier 2. Tier 1 key watersheds are those managed for at risk anadromous salmonids, bull trout, and resident fish. The Salmon River Watershed is the only designated Tier 1 watershed in the Sandy River Basin. Tier 2 key watersheds are those where high water quality is important. Designated Tier 2 watersheds include the Bull Run and Little Sandy Watersheds.

- **Watershed Analysis:** Watershed analysis was selected as a systematic procedure to characterize the aquatic, riparian, and terrestrial features within a watershed. Managers are to use information gathered during the watershed analysis to refine riparian reserve boundaries and prescribe land management activities.

- USFS has prepared watershed analyses for four of the watersheds in the Sandy River Basin: Zigzag River, Bull Run River, Salmon River, and Upper Sandy River (USFS 1995a, 1997, 1995b, and 1996, respectively).

- **Watershed Restoration:** Watershed restoration is designed to restore currently degraded habitat. Important components are control and restoration of road related runoff and sediment production, restoration of riparian vegetation, and restoration of instream habitat complexity.

In addition to the requirements of the Aquatic Conservation Strategy, the Northwest Forest Plan contains extensive provisions for the regulation of land use activities in forested environments for the protection of terrestrial habitats and species (such as the northern spotted owl). The Northwest Forest Plan includes four general land use categories that establish the objectives for appropriate use. Land management allocations within the Sandy River Basin portion of the Mt. Hood National Forest, as defined by the Northwest Forest Plan, are listed in Table 3.2-2.

Mt. Hood National Forest Land and Resource Management Plan

The Mt. Hood National Forest Land and Resource Management Plan (USFS 1990), as amended by the Northwest Forest Plan in 1994, provides the management direction for the national forest and the platform for determining consistency with all land use proposals, including habitat conservation plans. This plan was developed and enacted consistent with the requirements of the Forest and Rangeland Renewable Planning Act as amended by the National Forest Management Act (Shively 2000). The key goal of the Land and Resource Management Plan is "to manage the forest resources to protect and

Table 3.2-2 Northwest Forest Plan land allocations in the Sandy River Basin portion of the Mt. Hood National Forest

Name	Description	Percent Cover
Administratively Withdrawn	These lands include recreation and visual areas, backcountry, and other areas where management emphasis precludes scheduled timber harvest.	13
Congressionally Withdrawn	These lands have been reserved by act of Congress for specific land allocation purposes. For example – National Forest lands within the Bull Run Management Unit.	27
Late-successional Reserve	The objective of these reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems which serve as habitat for late-successional and old-growth related species, including the northern spotted owl.	33
Matrix	This land allocation is applied to all Federal lands not in Congressional Reserve, Late-successional Reserve, or Administratively Withdrawn allocations. In Matrix lands, standards and guidelines from the existing Land Resource and Management Plan apply, as well as Northwest Forest Plan standards and guidelines that apply to all land allocations.	27

Sources: USFS 1995a,b, 1996, 1997

maintain the character and quality of water; provide long term sustained production of water; and provide a favorable flow from the forest for both on-forest and off-forest water users."

BLM Land Management

BLM manages lands within the Bull Run Watershed and elsewhere in the Sandy River Basin. BLM lands are managed according to the Salem District BLM Resources Management Plan. Similar to the Northwest Forest Plan, the Salem District BLM Resources Management Plan identifies Tier 1 and Tier 2 key watersheds as part of an Aquatic Conservation Strategy (BLM 2005). Tier 1 key watersheds contribute directly to conservation of at-risk anadromous salmonids, bull trout, and resident fish species and have a high potential of being restored as part of a watershed restoration program (BLM 2005). The Salmon River is identified as a Tier 1 key watershed (BLM 2005), and portions of this river are located within the HCP action area. Tier 2 key watersheds do not contain at risk fish stocks, but they are important sources of high quality water (BLM 2005). The Tier 2 key watersheds in the Salem District are Bull Run River, Little Sandy River, and Eagle Creek. Of these three watersheds, the Bull Run River and Sandy River are located within the HCP action area. Key watershed designations place additional management requirements or emphasis on activities in those areas, such as performing watershed analysis and restoration (BLM 2005).

In conjunction with private organizations such as the Western Rivers Conservancy and The Nature Conservancy, BLM manages about 20 miles of Wild and Scenic rivers within the Sandy River and Salmon River Watersheds in addition to 9,000 acres in the Mt. Hood Corridor (ODEQ 2005). BLM land management activities are required to comply with Northwest Forest Plan requirements, as summarized in the preceding description of U.S. Forest Service Land Management.

Oregon Forest Practices Act

Non-Federal and private lands in the Sandy River Basin are regulated by the Oregon Forest Practices Act (ORS Chapter 527) with regard to the harvesting of timber, including restrictions on harvest in riparian areas. The Oregon Department of Forestry (ODF) is the designated management agency responsible for implementing the Forest Practices Act and its associated rules. The Water Protection Rules (OAR 629-635-000 through 629-660-060) focus on Riparian Management Areas for protection and restoration of water quality (ODF 2000). Riparian Management Areas are areas that extend along each side of specified waters of the State within which vegetation retention and special management practices are required to protect water quality, hydrologic functions, and aquatic and wildlife habitats.

Requirements for Riparian Management Areas are based on the type, size, and beneficial use of a water body. These water bodies are further distinguished based on size and beneficial use. Stream size is classified as small, medium, or large based on average annual flow. Stream use is designated as fish use (Type F), domestic use (Type D), or neither (Type N). According to OAR 629-635-200, "a stream or lake will be considered to have fish use if inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the Federal or state endangered species acts."

Forestry best management practices for riparian management areas include tree harvest prohibition areas; understory vegetation retention; snags and downed wood retention; basal area retention targets; live conifers retention; pre-commercial thinning and other activities to maintain the growth and survival of conifers; and variable width Riparian Management Area management. Restrictions are also imposed on the application of chemicals (e.g., pesticides, herbicides, fertilizers) in Riparian Management Areas and adjacent to fish bearing or domestic-use streams.

Local Zoning and Land Management

Municipal land use regulations are governed by Oregon's statewide land use goals. These goals include the protection of natural resources, scenic and historic areas, and open spaces; the protection of the quality of air, water, and land resources; and management of floodplains and other natural hazards.

Programs to comply with these land use goals are developed and codified in comprehensive plans and zoning ordinances adopted by the jurisdictions. The following jurisdictions have land use authorities in the Sandy River Basin: Multnomah and Clackamas Counties and the cities of Troutdale, Gresham, and Sandy. The urban growth boundary also extends into the basin and is managed by Metro, which is a directly elected regional government.

While all the jurisdictions have different plans and ordinances, the objectives in each case include protecting riparian resources in the basin and maintaining water quality. The primary mechanisms are establishing development setbacks based on stream size and slope, maintaining trees, controlling erosion, and planting native vegetation.

- **Clackamas County** established a River and Stream Conservation Area in 1997. Section 704 of the Clackamas County zoning and development ordinance (Title 12) defines requirements for all streams, which vary by stream size and designation. Fish bearing streams are addressed and policies are defined for the Sandy, Salmon, and Zigzag Rivers. Provisions include setbacks and native vegetation protection requirements. Section 1002 also includes provisions dealing with erosion control and habitat protection.

- In **Multnomah County**, streams are protected by the Significant Environmental Concern Zoning Overlay (MCC 11.15.6400). This overlay category covers "protected streams" mapped on the county zoning map. Streams are also regulated under either the East of Sandy River Rural Plan Area (adopted in 1997) or the West of Sandy River Rural Plan Area (adopted in 2002). The Sandy River, Beaver Creek, Kelly Creek, Smith Creek, Big Creek, Buck Creek, Gordon Creek, and Trout Creek are included. The mouth of the Sandy River is within the Columbia River Gorge National Scenic Area.

- **City of Troutdale** requirements affect the lower mainstem Sandy River and Beaver Creek. Relevant requirements are found in four sections of the development code: Vegetation Corridor and Slope District (4.300), Flood Management Area (4.600), Erosion Control (5.600), and Stormwater Management (5.800).

- **City of Gresham** policies affect Kelly Creek, which flows into Beaver Creek. The Kelly Creek Watershed is within Gresham's Water Quality Resource Area Overlay District (Section 5.0600). The district zoning standards require a setback and other related measures to protect the creek.

- The **City of Sandy** code requirements affect upland areas adjacent to a small portion of the middle mainstem Sandy River and Cedar Creek. The city's Flood and Slope Hazard Overlay is in Chapter 17.60 of the development code. Setbacks for the overlay zone are determined by stream size and proximity to wetlands.
- **Metro** has a Water Quality and Floodplain protection program (Title 3 in the Urban Growth Management Functional Plan). Title 3 requires local jurisdictions to meet regional performance standards relating to water quality and floodplain management. These standards are adopted via local zoning ordinances.

3.3 Vegetation

3.3.1 Regulatory Framework

The 1973 Endangered Species Act (16 U.S.C. 1531-1544) provides for the conservation of ecosystems (both through Federal action and by encouraging the establishment of state programs) on which threatened and endangered species depend. Relative to threatened and endangered plants, the ESA is enforced by the USFWS. Although take of listed plants is not prohibited under the ESA, section 7 of the Act provides for consideration of listed plant species during consultation. Issuance of an ITP must not jeopardize any listed species, including plants. ODFW prepares lists of special-status plant species under the authority of the Oregon ESA, and those plants are considered in this EIS.

3.3.2 Affected Environment

The action area is the Sandy River Basin, which encompasses all areas where covered activities would occur and conservation measures would be implemented (Figure 2.1-1).

The following subsections provide an overview of the habitat conditions in the Sandy River Basin and a description of the special-status species in the action area. Species status is described as it is classified by the USFWS and ODFW. Under both the Federal and state Endangered Species Acts, species can be listed as threatened or endangered. Threatened is the classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Endangered is the classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range. Species also can be defined as a "species of concern." Species of concern is an informal term, and it not defined in the Federal ESA. It commonly refers to species that are declining or appear to be in need of concentrated conservation actions.

3.3.2.1 Vegetative Cover in the Sandy River Basin

The Sandy River Basin is located adjacent to the Cascade Range of Northwestern Oregon, just east of the Portland metropolitan area. Over 86 percent of the basin is either deciduous or coniferous forest, with coniferous forests being far more prevalent. Typical riparian species in the basin include willow (*Salix* spp.), red alder (*Alnus rubra)*, big leaf maple (*Acer macrophyllum)*, western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii)*, and true firs (*Abies* spp.). The remaining area of the basin is urban, agricultural, or nonvegetated. The vegetative cover of the Sandy River Basin is characterized by 12 cover-type categories, as defined by the Oregon Gap Project of the Oregon Natural Heritage Program (ONHP). Table 3.3-1 lists the relative composition of these cover types within the basin.

Table 3.3-1 Vegetative cover composition in the Sandy River Basin

Vegetation Cover Type	Total Acres	Percent Composition[1] (%)
Forested Type		
Cottonwood Riparian Gallery	1,105	<1
Mixed Conifer/Mixed Deciduous Forest	6,324	2
Grass–Shrub–Sapling or Regenerating Young Forest	8,895	3
Douglas-fir–Western Hemlock–Western Redcedar Forest	208,950	65
Red Alder–Big Leaf Maple Forest	4,271	1
True Fir–Hemlock Montane Forest	43,264	14
Subalpine Fir–Lodgepole Pine Montane Conifer	2,005	<1
Subalpine Parkland	3,161	1
Nonforested Type		
Open Water	2,062	<1
Agriculture	31,705	10
Urban	6,235	2
Alpine Fell–Snowfields	2,511	<1
Total	320,488	100

Source: Sandy River Basin Partners 2005

[1] < = less than

There are six watersheds in the Sandy River Basin: Lower Sandy River, Middle Sandy River, Upper Sandy River, Salmon River, Zigzag River, and Bull Run River. The cover types vary in prevalence across the six watersheds as follows:

- Cottonwood–Riparian Gallery cover type is only found in the Lower Sandy River Watershed. This cover type depicts tall deciduous forests with partial-to-closed overstory canopy (Sandy River Basin Partners 2005). Cottonwood riparian stands are often mosaics of partial overstory canopy with dense understory reproduction to open areas dominated by willows to closed forests that may include conifers in the overstory (Sandy River Basin Partners 2005).

- Mixed Conifer/Mixed Deciduous Forest is found in the Bull Run River, Lower Sandy River, and Middle Sandy River Watersheds. Overstory canopy in this cover type is composed of co-dominant conifer, generally Douglas-fir and deciduous (generally red alder, and/or big leaf maple) trees (Sandy River Basin Partners 2005). Understory vegetation is negligible as the tightly crowded canopy casts deep and continuous shade upon the forest floor (Sandy River Basin Partners 2005).

- The Grass–Shrub–Sapling or Regenerating Young Forest cover type is found in all watersheds. This cover type captures the range of successional conditions following timber harvest (Sandy River Basin Partners 2005). As the stand matures, there may be a phase where resprouting shrub vegetation, or dormant shrub seeds germinated by prescription fire, dominates the overstory canopy layer (Sandy River Basin Partners 2005). Later in the successional phase, conifer saplings emerge through the shrub canopy and form continuous canopies (Sandy River Basin Partners 2005).

- Douglas-fir–Western Hemlock–Western Redcedar Forest is by far the most prevalent cover type and is found in each of the six watersheds. The Bull Run River and Salmon River Watersheds account for nearly 61 percent of this dominant cover type. In its mature form, this conifer forest type contains numerous large trees, multistory canopies, numerous snags, and downed logs (Sandy River Basin Partners 2005). Sub-canopies are composed of shade-tolerant conifer species and deciduous trees where there is discontinuous overstory canopy cover (Sandy River Basin Partners 2005).

- Red Alder–Big Leaf Maple Forest is found primarily in the Middle Sandy River Watershed, and to a lesser degree in the Salmon River and Upper Sandy River Watersheds.

This cover type is characterized by moderate height (20 to 50 ft.) closed canopy deciduous forest (Sandy River Basin Partners 2005). Upland red alder and alder/big leaf maple forests are early seral forest to the low elevation conifer forests of Douglas-fir, western hemlock, and western redcedar (Sandy River Basin Partners 2005).

- True Fir–Hemlock Montane Forest is found in upper elevations of all watersheds except the Lower Sandy River Watershed. This cover type is characterized by multistory, closed canopy forests (Sandy River Basin Partners 2005). Trees can grow to large stature, barring disturbance in these fertile, mid-elevation forests (Sandy River Basin Partners 2005). Snags and large woody debris are commonly found (Sandy River Basin Partners 2005). Understory vegetation is rich in species with a diversity of forms (Sandy River Basin Partners 2005).

- Subalpine Fir–Lodgepole Pine Montane Conifer is found only in the Salmon River Watershed. Short stature, single-story canopy forests characterize this cover type (Sandy River Basin Partners 2005). Crown closure ranges from open to closed (Sandy River Basin Partners 2005). At its lower elevation range, this cover type grades into various montane forest types and maintains a continuous canopy (Sandy River Basin Partners 2005). At its upper elevation range, the type grades into subalpine parkland, or it takes on the clumpy appearance of a parkland cover type (Sandy River Basin Partners 2005).

- Subalpine Parkland is found in the upper reaches of the Sandy River Basin within the Salmon River, Upper Sandy River, and Zigzag River Watersheds. Subalpine parkland is distinctive from subalpine grasslands and shrublands due to the presence of the clumpy, scattered tree pockets throughout the cover type (Sandy River Basin Partners 2005). Conifer overstory typically ranges from 10 to 30 percent cover (Sandy River Basin Partners 2005). Ground layer can be a dense layer of low-lying shrubs, sedge or grass turf, or montane wetland bogs (Sandy River Basin Partners 2005).

- Open Water is found in the Bull Run River (two Bull Run Reservoirs and Bull Run Lake), Lower Sandy River (Roslyn Lake), and Zigzag River (Trillium Lake) Watersheds.

- Agriculture is primarily found in the Lower and Middle Sandy River Watersheds.

- Urban is found mostly in the Lower Sandy River Watershed, with the exception of a portion of the City of Sandy in the Middle Sandy River Watershed.

- The Alpine Fell-Snowfields cover type is found on the summit of Mt. Hood, at the uppermost portions of the Upper Sandy River, Salmon River, and Zigzag River Watersheds. This cover type depicts the nonvegetated areas above upper treeline in the highest mountains throughout the state (Sandy River Basin Partners 2005). Persistent snow cover and rock talus slopes dominate the local landscape (Sandy River Basin Partners 2005).

3.3.2.2 Special Status Species in the Sandy River Basin

As described above, the Sandy River Basin supports 12 vegetative-cover types. The Bull Run HCP does not include coverage for any plant species; however, special-status plant species do occur in the basin. Special-status plant species known to occur in the Sandy River Basin are listed in Table 3.2-2 and are described in the following text.

Table 3.3-2 Federal and state listed and other special-status plant species known to occur in the Sandy River Basin

Common Name	Scientific Name	Federal Status	State Status
Tall Bugbane	*Cimicifuga elata*	SOC	C
White Rock Larkspur	*Delphinium leucophaeum*	SOC	E
Peacock Larkspur	*Delphinium pavonaceum*	SOC	E

Source: Oregon Natural Heritage Program 2001 (as found in ODFW, 2002)

T = Threatened
C = Candidate
SOC = Species of Concern
E = Endangered

Tall Bugbane (*Cimicifuga elata*)

Tall bugbane is a Federal species of concern and is state-listed as a candidate species. Primary threats to this species include habitat loss or modification due to timber management practices (Washington Department of Natural Resources 1998). Its range extends west of the Cascades into southern Oregon. Oregon populations occur on land managed by the USFS at the Willamette, Mt. Hood, Umpqua, and Rogue River National Forests; and at the Salem, Eugene, Roseburg, and Medford BLM Districts. This woodland perennial generally grows well in both shady, moist, mixed, mature western redcedar–hemlock and Douglas-fir stands and in mixed deciduous stands. The deciduous

stands provide a balance of shade and light, as well as moisture retention. This species begins flowering in late May and continues flowering into early August.

White Rock Larkspur (*Delphinium leucophaeum*)
White rock larkspur is a Federal species of concern and is state-listed as endangered. Its range extends from the northern Willamette Valley in western Oregon to one site in Lewis County, Washington, in the Puget Trough. Land conversions to agricultural and residential use have resulted in significant losses of habitat and plants (Washington Department of Natural Resources 1998).

White rock larkspur is a slender perennial that grows from a cluster of small bulbs. It is a prairie species that grows on dry bluffs and cliffs with shallow soils. It is now largely restricted to roadside ditches and fencerows. White rock larkspur and peacock larkspur (described below) are the only white or cream-colored larkspurs west of the Cascades.

Peacock Larkspur (*Delphinium pavonaceum*)
Peacock larkspur is a Federal species of concern and is state-listed as endangered. This white-flowered perennial is found only in the Willamette Valley of Oregon. Peacock larkspur grows in well-drained areas of native prairie, especially roadsides that have escaped development. In floodplains, it can be found on high-mound areas that are better drained than the surrounding prairie. Because nearly all grassland habitat has been converted to agricultural and residential use, peacock larkspur is now found almost exclusively along fencerows and ditches where there are small patches of habitat (Center for Plant Conservation 2007b).

3.4 Birds and Mammals

3.4.1 Regulatory Framework

3.4.1.1 Federal Endangered Species Act

The 1973 Endangered Species Act (16 U.S.C. 1531-1544) provides for the conservation of ecosystems (both through Federal action and by encouraging the establishment of state programs) upon which threatened and endangered species depend. With regard to birds and mammals, the ESA is enforced by the USFWS. Section 9 of the ESA and accompanying Federal regulations prohibit the unauthorized take of fish and wildlife species listed as threatened or endangered by government, private companies, or individuals. As defined in the ESA, take means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in such conduct." By regulation, harm is defined as any act that "actually kills or injures" listed wildlife. Harm also could include "significant habitat

modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Section 7 of the ESA provides for consideration of listed species during consultation; issuance of an ITP must not jeopardize any listed species.

3.4.1.2 Oregon Endangered Species Act

The Oregon Endangered Species Act (Oregon ESA) was enacted in 1987. It requires the conservation of listed species and defines conservation as "the use of methods and procedures necessary to bring a species to the point at which the measures provided under ORS 496.171 to 496.182S are no longer necessary. Such methods and procedures include, but are not limited to, activities associated with scientific resource management such as research, census taking, law enforcement, habitat acquisition and maintenance, propagation and transplantation." When a species is listed, the Oregon Fish and Wildlife Commission must establish "quantifiable and measurable guidelines," otherwise known as survival guidelines, "that it considers necessary to ensure the survival of individual members of the species." In addition, ODFW prepares lists of special-status species under the authority of the Oregon ESA. Bird and mammal species listed under the Oregon ESA also are considered in this EIS.

3.4.1.3 Migratory Bird Treaty Act

The 1918 Migratory Bird Treaty Act makes it unlawful to pursue, hunt, capture, kill, possess, or attempt to do the same to any migratory bird or part, nest, or egg of such bird listed in wildlife protection treaties between the United States and Great Britain, the Republic of Mexico, Japan, and Russia. The Act authorizes the Secretary of the Interior to issue Special Purpose Permits. The procedures for securing such permits are found in Title 50 of the *Code of Federal Regulations* (CFR). An ITP issued under section 10 of the ESA also constitutes a Special Purpose Permit under 50 CFR 21.27. As such, any take allowed under an ITP would not violate the Migratory Bird Treaty Act. This does not apply to the bald eagle, which is protected under other regulations.

3.4.1.4 U.S. Forest Service Land Management

Management activities in the Mt. Hood National Forest are guided, in part, by the Northwest Forest Plan (USFS 1994a). The Northwest Forest Plan was established in 1994 to protect large blocks of late-successional forest and to provide habitat for species that depend on those forests, including the spotted owl. The Northwest Forest Plan included land use allocations that would provide for population clusters of spotted owls (i.e., demographic support) and maintain connectivity between population clusters. Land use allocations included late-successional reserves, adaptive management reserves,

congressionally reserved lands, managed late-successional areas, and larger blocks of administratively withdrawn lands. Most of the Bull Run water supply drainage is designated as late-successional reserve. This land use classification placed extensive administrative controls on timber harvest and other land uses on Federal land in the Bull Run Watershed. The Northwest Forest Plan is discussed in more detail in Subsection 4.2, Land Use.

3.4.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities.

The following subsections provide an overview of the habitat conditions in the Sandy River Basin, a description of the special-status bird and mammal species addressed under the Bull Run HCP, and a description of other special-status bird and mammal species in the Sandy River Basin.

Species status is described as it is classified by USFWS and ODFW. Under both the Federal and state Endangered Species Acts, species can be listed as threatened or endangered. Threatened is the classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Endangered is the classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range. Species can be defined as a "species of concern." Species of concern is an informal term, and it not defined in the Federal ESA. It commonly refers to species that are declining or appear to be in need of concentrated conservation actions.

In addition, ODFW has the special-status species classifications "vulnerable" and "critical." A vulnerable species is one for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. A critical species is one for which listing as threatened or endangered is pending, or those species for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken.

3.4.2.1 Bird and Mammal Habitat in the Sandy River Basin

The Sandy River Basin is located adjacent to the Cascade Range of Northwestern Oregon, just east of the Portland metropolitan area. The Sandy River Basin makes up a relatively small part of the Lower Columbia portion of the much larger Columbia River Basin. From its high elevation alpine zones to its lower elevations, the Sandy River Basin provides diverse habitats for a wide variety of wildlife species.

The basin is located in the Pacific Flyway and is used by migratory birds as resting or nesting grounds during migration. A rich diversity of amphibian and reptile species is found in the rivers, streams, marshes, and ponds (amphibians and reptiles are discussed in Subsection 3.5 of this EIS). Mammal species living in the basin include Roosevelt elk, black-tailed deer, black bear, coyote, cougar, bobcat, otter, raccoon, beaver, mink, and wolverine. The habitats adjacent to the rivers and tributaries provide important travel corridors for wildlife movement and dispersal. The Bull Run Watershed also contains important upland habitat for bald eagles and spotted owls.

3.4.2.2 Bird and Mammal Species Addressed in the Bull Run HCP

The Bull Run HCP includes conservation measures for two threatened bird species (the state-listed bald eagle and the Federal- and state-listed northern spotted owl) and one candidate mammal species (fisher). Status, habitat needs, and distribution are described generally for each of these species in this subsection. Detailed information about each species is provided in Section 5.6 of the Bull Run HCP.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is a state-listed threatened species (ODFW 2005a). The bald eagle previously was a federally threatened species. However, USFWS proposed removing the bald eagle from the list of threatened and endangered species, and the final delisting rule was published in the Federal Register on July 9, 2007, with an effective date of August 8, 2007. Under ESA regulations, USFWS will continue to work with state wildlife agencies to monitor bald eagles for at least five years.

In western Oregon, the bald eagle is found in the Willamette Valley, along the Columbia River, at the coast, and along most major rivers in the southwestern portion of the state (Csuti et al. 1997).
Bald eagles typically nest in large, super-dominant trees in forested areas adjacent to large bodies of water and in areas not subject to intense human activity (Anthony et al. 1982; Anthony and Isaacs 1989; Watson and Pierce 1998; Stinson et al. 2001). Douglas-fir, Sitka spruce, and western hemlock are used as nest trees in western Oregon (Anthony et al. 1982).

Foraging habitat consists of large areas of open water with fish and waterfowl populations that are available to eagles (Buehler 2000). Many bald eagles congregate at communal winter roosts in areas of abundant prey, primarily fish, including salmon, and waterfowl. Winter roost use is primarily influenced by the abundance and distribution of prey and only secondarily influenced by roost characteristics (Watson and Pierce 1998). Stands with the largest and most decayed trees are most often used for roosting (Stinson et al. 2001).

There are no known bald eagle nest sites in the Bull Run Management Unit, though bald eagles are periodically reported around the reservoirs according to the Oregon Natural Heritage Information Center (ORNHIC 2004; Isaacs 2006; Robbins 2006). One active bald eagle nest is located along the Bull Run River downstream of the management unit (ORHNIC 2004; Isaacs and Anthony 2004). There are no known winter communal roost areas in the Sandy River drainage.

Currently, there are power lines located in the action area that are part of the existing water supply facilities. The potential for bald eagles to be affected by power lines is low because of the relatively small resident bald eagle population and the bald eagle's ability to avoid collisions with overhead power lines (except during periods of poor visibility). Moreover, there have been no reported bald eagle collisions with power lines in the Bull Run Watershed (personal communication with R Marheine, Portland General Electric, Terrestrial Wildlife Biologist, January 30, 2006).

Northern Spotted Owl (*Strix occidentalis caurina*)

The northern spotted owl is a Federal- and state-listed threatened species (ODFW 2004). The primary threats to the spotted owl are the loss, modification, and fragmentation of habitat.

The spotted owl is a permanent resident of the temperate conifer forests of the Pacific Northwest, ranging from southern British Columbia through Washington and Oregon to northern California, along the Cascades and coastal mountain ranges (USFWS 1990). Spotted owls are forest dwellers. They use a variety of conifer-dominated forest types for nesting in the Pacific Northwest (Gutiérrez et al. 1995). Nests are generally in mature, old forest stands having more forest structure and complexity than random sites (Forsman et al. 1984; Solis and Gutiérrez 1990; Carey et al. 1990, 1992).

Spotted owls nest frequently in Douglas-fir, western hemlock, and western redcedar (Hershey et al. 1998). Spotted owls appear to use a wider variety of forest conditions for foraging than for nesting or roosting (Thomas et al. 1990). Foraging habitat consists of forest stands with a high canopy closure and complex forest structure (Gutiérrez et al. 1995).

The best available information on spotted owl sites in the Sandy River Basin is from a 2-year survey conducted in 1993 and 1994 (Robbins 2006). According to that study, there were 49 resident spotted owl sites within the Sandy River Basin, including one on City lands and 21 on USFS lands in the Bull Run Watershed. Of these 21 sites, seven are within 1.2 miles of City lands. The current status of the sites is unknown. In addition to the 49 sites, a search of the ORNHIC database identified three additional spotted owl sites in the upper Sandy River Basin outside the Bull Run Watershed (ORNHIC 2004).

Fisher (*Martes pennanti*)

The West Coast distinct population segment of the fisher is listed as a candidate for Federal listing (USFWS 2006). The USFWS 12-month findings found listing of the fisher to be warranted, but precluded (1994). The principal threats to the fisher's distinct population segment are related to isolation of populations and continued fragmentation of suitable habitat.

The fisher is found across Canada and the United States – from New England to the upper Midwest, the northern Rockies, and the western mountains, and south to the Sierra Nevada in California (Csuti 1997). The range of the fisher includes southwest Oregon, the south half of the Cascades, and northeastern Oregon (Csuti 1997). Fishers have been most commonly associated with low to mid-elevation forests in the Pacific States, up to 8,200 feet (Grinnell et al. 1937, and Schempf and White 1977, both cited in Powell and Zielinski 1994; Aubrey and Houston 1992).

Fishers are associated with older closed canopy forests with abundant large coarse woody features (snags and logs) and understory vegetation (Buck et al. 1983). In the Pacific Northwest, fishers are more frequently found in late-successional forests than in early- to mid-successional forests as a result of timber harvesting.

Natal dens are most often elevated cavities in snags or trees (Buck et al. 1983), but occasionally logs and rock formations are used. Maternal dens have been located in a variety of tree species in the West, including quaking aspen, black oak, black cottonwood, incense cedar, Douglas-fir, white and grand fir, pine, and golden chinquapin (Buck 1982).

Fishers tend to forage in habitats or microhabitats with high densities of prey (Powell 1977, cited in Powell and Zielinski 1994). Because food habit studies have not been conducted in the West for this species, it is assumed that snowshoe hare habitat (a common prey species of fisher in other areas of the country) constitutes suitable foraging habitat (Lewis and Stinson 1998).

There are no recent records of fishers in the Sandy River Basin (ORNHIC 2004) and the closest known fisher population exists in the south and central Oregon Cascades, north into southern Linn County (Csuti et al. 1997). Fishers are not expected to be present in the Sandy River drainage.

3.4.2.3 Other Special-Status Bird and Mammal Species in the Sandy River Basin

In addition to the three species described above, four other special-status species are known to occur in the Sandy River Basin. Based upon guidance from local resource professionals, these four species have

the potential to be affected by the Proposed Action or alternatives: harlequin duck, willow flycatcher, olive-sided flycatcher, and band-tailed pigeon. These species are described in this subsection.

Harlequin Duck (*Histrionicus histrionicus*)

Harlequin duck is a Federal species of concern (USFWS 2005). Globally, the harlequin duck occurs over a wide geographic range in four separate populations. The western population breeds in Alaska, Yukon Territory, British Columbia, Alberta, Montana, Wyoming, Idaho, and Washington. Western birds winter from the Aleutian Islands south, including in Alaska, British Columbia, Washington, Oregon, and California.

During most of the year, this species can be found in coastal marine environments. In spring, however, they leave the salt water to ascend fast-flowing rivers and streams to breed. The well-concealed nest is located close to a stream in the surrounding riparian habitat whether on the ground, in a tree cavity, or in a stump (Seattle Audubon Society 2005a). During winter, harlequin ducks congregate at traditional sites to feed in the swirling waters of shallow and rocky coastal areas (Seattle Audubon Society 2005a). In northern wintering areas, they seek rocky shores and ledges near turbulent water where ice buildup is minimal (Seattle Audubon Society 2005a).

There are two known occurrences of the harlequin duck in the action area. One pair was observed in 1986 in the Middle Sandy River Watershed and four males were observed in 2006 in the Salmon River and the Upper Sandy River Watersheds (ORHNIC 2007).

Willow Flycatcher (*Empidonax traillii brewsteri*)

The willow flycatcher is a state-listed vulnerable species (ODFW 1997b). Destruction of riparian and meadow habitats is thought to be the principal cause for its decline. Other contributing factors may include nest parasitism by brown-headed cowbirds, disturbance from grazing, and disturbance on wintering grounds. This species' range includes central/coastal California and north through western Oregon and Washington, to Vancouver Island.

The willow flycatcher prefers broad, open river valleys or large mountain meadows with lush growth of shrubby willows, wet meadows, and montane riparian habitats between 2,000 and 8,000 feet in elevation. They forage by either gleaning insects from vegetation while flying or by waiting on an exposed perch and capturing insects in flight (Ettinger and King 1980). Deciduous trees and shrubs interspersed with open areas enhance the quality of foraging habitat.

This species has been observed in the action area as part of the Wetland Wildlife Watch, a project jointly administered by USFS, specifically the Mt. Hood National Forest, and the Northwest Ecological

Research Institute, a non-profit organization (Northwest Ecological Research Institute 1987 to 2006). In addition, suitable habitat for this species is present in the action area.

Olive-sided Flycatcher (*Contopus cooperi [=borealis*])

The olive-sided flycatcher is a Federal species of concern and a state-listed vulnerable species (USFWS 2005; ODFW 1997b). The cause of decline in this species decline is unknown, but it may be due to habitat loss on the wintering grounds or a decrease in suitability of habitat on the breeding grounds (Seattle Audubon Society 2005b). The olive-sided flycatcher is widespread: from western and central Alaska across the boreal and mixed forests of Canada to southern Labrador, Newfoundland, and the Maritime provinces; and farther south to central Minnesota, northern Michigan, northeastern Ohio, the Adirondack Mountains, and western Massachusetts.

This species is most often associated with forest openings, forest edges near natural openings (e.g., meadows, bogs, canyons, rivers) or man-made openings (e.g., harvest units), or open to semi-open forest stands. Its presence in early successional forests appears dependent on availability of snags or residual live trees for foraging and singing perches. Other olive-sided flycatcher habitats include wooded shores of streams, lakes, rivers, beaver ponds, bogs and muskegs, where natural edge habitat occurs and standing dead trees often are present.

This species has been observed in the action area as part of the Wetland Wildlife Watch (Northwest Ecological Research Institute 1987 to 2006). In addition, suitable habitat for this species is present in the action area.

Band-tailed Pigeon (*Columba fasciata)*

The band-tailed pigeon is a Federal species of concern (USFWS 2005). Loss and degradation of habitat is a continuing threat for the species, but more research is needed to determine the specific factors contributing to its decline. In North America, it is distributed along the coastal areas from southern Alaska into Baja, California.

The band-tailed pigeon is an inhabitant of woodlands. In the northern Pacific region it inhabits conifer rain forest. There is little information about migratory behavior, but presumably migration is diurnal because there are numerous reports of large flocks flying in daylight, especially in the fall. Nest building is on tree branches over a 3- to 6-day period and consists of twigs placed crosswise over each other, much like the mourning dove. Generally, one egg is laid and both parents incubate with hatching occurring in 16 to 22 days. The peak nesting period is generally in early to mid-summer. Second and third successful nestings are not unusual.

This species has been observed in the action area as part of the Wetland Wildlife Watch (Northwest Ecological Research Institute 1987 to 2006). In addition, suitable habitat for this species is present in the action area.

3.5 Amphibians and Reptiles

3.5.1 Regulatory Framework

3.5.1.1 Federal Endangered Species Act

The 1973 Endangered Species Act (16 U.S.C. 1531-1544) provides for the conservation of ecosystems (both through Federal action and by encouraging the establishment of state programs) upon which threatened and endangered species depend. With regard to amphibians and reptiles, the ESA is enforced by the USFWS. The ESA is described in detail in Subsection 1.1.2.1, Endangered Species Act.

3.5.1.2 Oregon Endangered Species Act

The Oregon Endangered Species Act was enacted in 1987. It requires the "conservation" of listed species, and defines "conservation" as "the use of methods and procedures necessary to bring a species to the point at which the measures provided under ORS 496.171 to 496.182 (Oregon ESA) are no longer necessary. Such methods and procedures include, but are not limited to, activities associated with scientific resource management such as research, census taking, law enforcement, habitat acquisition and maintenance, propagation and transplantation." When a species is listed, the Oregon Fish and Wildlife Commission must establish "quantifiable and measurable guidelines," otherwise known as survival guidelines, "that it considers necessary to ensure the survival of individual members of the species."

ODFW also prepares lists of special-status species under the authority of the Oregon ESA. Amphibian and reptile species listed under the Oregon ESA also are addressed in this EIS. In addition, the Oregon ESA applies to actions of state agencies on state-owned or leased lands, including issuance of permits to alter streambeds under the jurisdiction of the Oregon Department of State Lands (DSL).

3.5.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and/or potentially affected by covered activities.

The action area contains a rich diversity of amphibian and reptile species in rivers, streams, marshes, and ponds. The habitats adjacent to the rivers and tributaries provide important travel corridors for wildlife movement and dispersal. No amphibians and reptiles are proposed covered species; however, the Bull Run HCP includes conservation measures for eight amphibian and two reptile species: Cope's giant salamander, the Cascade torrent salamander, the clouded salamander, the Oregon slender salamander, the coastal tailed frog, the northern red-legged frog, the Cascades frog, the western toad, the western painted turtle, and the northwestern pond turtle. These species also are addressed in this EIS. The Larch Mountain salamander is not addressed in the HCP because it has not been documented to occur in the action area; however, suitable habitat for this species is present in the action area. For this reason, potential impacts to Larch Mountain salamander are analyzed in this EIS.

The species status, habitat needs, and distribution for each of these species described in the following subsection. Life histories for the amphibian species and the reptile species are described in Sections 5.5.1 and 5.5.2, respectively, of the Bull Run HCP.

Species status is described as it is classified by ODFW. ODFW species classifications are defined in Table 3.5-1. Some species also are classified as Federal species of concern. Species of concern is an informal term, and it is not defined in the Federal ESA. It commonly refers to species that are declining or appear to be in need of concentrated conservation actions.

3.5.2.1 Amphibian Species Addressed in the Bull Run HCP

Western Toad *(Bufo boreas)*

The western toad is currently classified as a sensitive to vulnerable species in Oregon (ODFW 2005a). Although widespread, the species is particularly susceptible to recently emerging fungal diseases (Blaustein and Wake 1990; Blaustein and Olson 1991; Blaustein et al. 1994; Stebbins and Cohen 1995; Kiesecker and Blaustein 1997; Daszak et al. 1999). It is a habitat generalist, except for its requirement of breeding sites with little or no shade and a mud or sand substrate.

Only one breeding population is known in the Sandy River Basin, although adult toads are found in the upper Salmon River drainage. This population of at least 500 individuals uses the upper Bull Run Watershed year-round and breeds in Bull Run Reservoir 1, where an extensive bench on the north side is inundated at full pool (Corkran unpublished data). Water stored in the reservoirs creates ideal breeding habitat for this species, likely replacing off-channel habitat that occurred along the Bull Run River before the dams were constructed. Over decades of continued water storage, extensive bars of fine debris have built up at the head of Reservoir 1, which may be increasing the available breeding

Table 3.5-1 Oregon Department of Fish and Wildlife sensitive-species classification definitions

Term	Definition
Sensitive Species	Sensitive species constitute those naturally reproducing native animals which may become threatened or endangered throughout all or any significant portion of their range in Oregon.
Critical	Species for which listing as threatened or endangered is pending, or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species which are at risk throughout their range and some disjunct populations.
Vulnerable	Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases, populations are sustainable and protective measures are being implemented; in others, populations may be declining and improved protective measures are needed to maintain sustainable populations over time.
Peripheral or Naturally Rare	Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those which had low population numbers historically in Oregon because of naturally limiting factors. Maintaining the status quo is a minimum necessity. Disjunct populations of several species which occur in Oregon should not be confused with peripheral species.
Undetermined Status	Species for which status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical or vulnerable status but scientific study would be needed before a judgment can be made.

Source: ODFW 1997b

shallows. However, the recent invasion of reed canarygrass is shading the water and substrate, reducing insolation required for rapid development of eggs and larvae.

Cascades Frog (*Rana cascadae*)

The Cascades frog is classified as a Federal species of concern and a sensitive to vulnerable species in Oregon (ODFW 2005a). Declining population trends and lack of breeding at many of its historical localities, apparently caused by infectious diseases and anthropogenic factors, are reasons for the current classifications (Blaustein and Wake 1990; Blaustein and Olson 1991; Fellers and Drost 1993; Blaustein et al. 1994; Kiesecker and Blaustein 1997; Oregon Natural Heritage Information Center 2003; NatureServe, 2005). The Cascades frog inhabits montane wet meadows and ponds.

In the Sandy River Basin, the Cascades frog is common only in higher elevations, where wet meadows occur on relatively level terrain (Corkran unpublished data). The largest populations are near the

southern edge of the basin at several headwaters of the Salmon River and in the south buffer of the Bull Run Watershed at the head of the Little Sandy River. A small breeding site existed north of Bull Run Reservoir 1, but has filled in and is no longer used by Cascades frogs (Corkran unpublished data). Within the action area, potential breeding habitat occurs in wetlands, as well as summering habitat along many of the forested tributary streams.

Northern Red-legged Frog (*Rana aurora aurora)*

The northern red-legged frog is currently classified as a Federal species of concern and a sensitive to undetermined status species in Oregon, except in the Willamette Valley where it is considered a sensitive to vulnerable species (ODFW 2005a). Habitat loss; predation by introduced warm-water fish and American bullfrogs (*Rana catesbeiana*), which pose unnatural risks of predation, competition, and disease; pesticides; and other pollutants are thought to have impacted Willamette Valley populations, but in other regions of Oregon numbers of northern red-legged frogs appear to be more stable (ORNHIC 2003; NatureServe 2005). The northern red-legged frog inhabits coniferous and deciduous forest, ponds with cool water, and forested stream edges.

Red-legged frogs are widely distributed in the Sandy River Basin up to approximately 2,000 feet above mean sea level (msl) (Corkran unpublished data). Numerous small breeding sites occur at the lower end of the basin, where they are vulnerable to predation by American bullfrogs and particularly by warm-water fish. In recent years, red-legged frogs have not been observed at several former breeding sites at the Sandy River delta (Corkran unpublished data). A large and apparently stable population of approximately 800 frogs breeds in shallows at the head of Bull Run Reservoir 1, with another large aggregation in ponds near the south side of Reservoir 2 (Corkran unpublished data). These sites have water temperatures too cold for invasion by warm-water fish or American bullfrogs.

Storage of water in the Bull Run Reservoirs provides breeding habitat, and long term water storage has resulted in extensive bars of fine debris, which may be increasing available breeding habitat. However, the reservoirs also attract American beavers, whose activity affects the growth of small willows used for egg attachment by the frogs (Corkran unpublished data). In addition, recent invasion by reed canarygrass may be adversely affecting native sedges and other vegetation used by red-legged frogs for egg deposition and larval development (Corkran unpublished data). Northern red-legged frogs summer along cold water tributaries of the Bull Run River; however, their level of use of the river below Dam 2 is unknown (Corkran unpublished data).

Coastal Tailed Frog *(Ascaphus truei)*

The coastal tailed frog is classified as a Federal species of concern and a sensitive to vulnerable species in Oregon (ODFW 2005a). Irregular distribution and evidence of declining population trends, mostly caused by habitat loss or degradation, are reasons for its current classification (ORHNIC 2003; NatureServe 2005). Coastal tailed frogs inhabit small and medium-sized streams with cobble or boulder substrate and little or no silt, and riparian areas that are usually old-growth conifer forest (Bury et al. 1991 a and b; Welsh 1990).

This species is widespread within the upper Sandy River Basin, except for the major rivers and streams. It occurs in many of the tributaries of the upper Bull Run, Sandy, and Salmon Rivers and in upper Gordon Creek (Corkran unpublished data). Populations have not been systematically monitored, but they appear to be stable, with habitat minimally degraded in recent years by logging and road building (Corkran unpublished data).

Cope's Giant Salamander (*Dicamptodon copei*)

The Cope's giant salamander is classified as a sensitive to undetermined status species in Oregon (ODFW 2005a). The reasons for this classification are that several aspects of its life history are still unknown; its population size and trend are unknown; and it is vulnerable to logging, road building, and other activities that increase sedimentation in streams (Bury et al. 1991b; ORHNIC 2003; NatureServe 2005). Cope's giant salamander habitat is limited to small, cobble-substrate, higher gradient streams with little or no silt and logs or rocks with crevices for nest sites. Because it is not known to metamorphose in Oregon, its use of terrestrial habitats for foraging or dispersal is restricted to streambanks and very wet conditions (Corkran unpublished data).

The Cope's giant salamander is sporadically distributed in the upper Sandy River Basin. Known populations occur in the headwaters and many smaller tributaries of the Bull Run River and in Still Creek, Mud Creek, Gordon Creek, and Cedar Creek, which is near the southwestern edge of its known range (Corkran unpublished data). Little is known about its population status in the basin, but its habitat particularly within the Bull Run Watershed has not been degraded in recent years.

Cascade Torrent Salamander (*Rhyacotriton cascadae*)

The Cascade torrent salamander is currently classified as a sensitive to vulnerable species in Oregon because of habitat impacts from logging, road building, or other ground-disturbing activities that cause sedimentation or warmer water temperatures (ODFW 2005, Murphy and Hall, 1981; Bury and Corn, 1988; Corn and Bury, 1989; Bury et al.; 1991b; and Oregon Natural Heritage Information Center,

2003). Cascade torrent salamander habitat is restricted to cold, gravelly springs, seeps, headwater streams, and adjacent forests for some dispersal and foraging.

The distribution of the Cascade torrent salamander in the Sandy River Basin is similar to that of Cope's giant salamander. Cascade torrent salamanders are known to occur only in the headwaters of the Bull Run River and its tributaries, and in several other small streams in the basin (Corkran unpublished data). Little is known about its population status in the basin, but its habitat, particularly within the Bull Run Watershed, has not been degraded in recent years.

Clouded Salamander (*Aneides ferreus)*

The clouded salamander is classified as a sensitive to vulnerable species in Oregon because of habitat loss from logging of old growth forests (ODFW 2005). It is entirely a terrestrial species, closely associated with large diameter, down logs in conifer forests and forested talus or rock outcrops. Clouded salamanders are occasionally found in riparian forests with mixed conifer and deciduous trees. Although this species is not well studied, it is likely that its home range may be measured in square yards and its dispersal distance is probably limited (Stebbins and Cohen 1995).

The clouded salamander is widely distributed but very uncommon in the Sandy River Basin. The basin is near the northern end of its geographic range. Individuals have been found at several locations in the Bull Run Watershed and at one site next to the Salmon River (Corkran unpublished data). Northwest Forest Plan land allocations in the Sandy River Basin Late include late-successional reserve status for much of the Bull Run Watershed, which is maintaining mature and old growth conifer forest that will continue to provide habitat for clouded salamanders (see Subsection 3.2.1.1, U.S. Forest Service Land Management, for more details regarding the Northwest Forest Plan).

Oregon Slender Salamander *(Batrachoseps wrightorum [= wrighti]*)

The Oregon slender salamander is classified as a Federal species of concern and a sensitive to undetermined status species in Oregon because of habitat loss from logging of old growth forests (ODFW 2005). It is a terrestrial species, strongly associated with large, well decayed down logs, primarily Douglas-fir, under dense forest canopy, but it also uses shaded talus habitat. Oregon slender salamanders are generally not found in deciduous, riparian forests. Its home range is probably measured in square feet and its dispersal capability is probably very limited (Stebbins and Cohen 1995).

The Oregon slender salamander is widely distributed in the majority of the Sandy River Basin that is covered by coniferous forest, but its occurrence is probably very patchy. Old growth stands in the

Bull Run Watershed and along the Salmon River harbor large populations of this species (Gilbert and Allwine 1991; Corkran unpublished data). Northwest Forest Plan land allocations in the Sandy River Basin include late-successional reserve status for much of the Bull Run Watershed, which is maintaining mature and old growth stands that will continue to provide habitat for Oregon slender salamanders.

3.5.2.2 Reptile Species Addressed in the Bull Run HCP

Western Painted Turtle (*Chrysemys picta belli*)

The western painted turtle is classified as a sensitive to critical species in Oregon (ODFW 2005). Nest predation by raccoons and predation of hatchlings and juveniles by exotic warm-water fish and American bullfrogs limit recruitment into most populations (Northwest Ecological Research Institute, 1998; Oregon Natural Heritage Information Center, 2003; NatureServe 2005). Western painted turtles inhabit large ponds and slow rivers with abundant basking sites and adjacent, sunny open areas for nesting.

The only known population of western painted turtles in the Sandy River Basin is at the Sandy River Delta. Although no formal surveys have been conducted since 1992, turtles are still present in the ponds, the slough, and along the river near its mouth (Salix Associates 1992; Beilke 2005). Reproduction is still occurring, but in 2004, several depredated nests were found near the small ponds south of the slough (Barnes 2005). Invasive plants, such as Himalayan blackberry and reed canarygrass, are detrimental to nesting sites for this species because they create shade and barriers to movement on banks of ponds and rivers used by these species for basking and nesting, and their roots interfere with digging into the soil for nest building (Corkran unpublished data).

Northwestern Pond Turtle (*Emys [= Clemmys] marmorata marmorata*)

The northwestern pond turtle is classified as a Federal species of concern and a sensitive to critical species in Oregon (ODFW 2005). Habitat loss; lack of recruitment because of high predation rates from raccoons, introduced warm-water fish, and American bullfrogs; and pneumonia epidemics that are probably related to pollution and other anthropogenic stressors are factors in the declining populations of this species (Holland, 1994; Oregon Natural Heritage Information Center, 2003; NatureServe, 2005). Northwestern pond turtle habitat requirements are ponds and river backwaters with abundant basking sites, adjacent sunny areas for nesting, and open woods for terrestrial wintering.

There is no known population of northwestern pond turtles in the Sandy River Basin. Individuals of this species are occasionally seen in the Columbia Slough, although none have been reported from the

Sandy River Delta (Salix Associates 1992; Barnes 2005; Beilke 2005). Because this species travels fairly long distances, is often transported by people, and is wary and secretive in its behavior, it is possible that individuals do occur at the Sandy River Delta where appropriate habitat does exist.

3.5.2.3 Other Special-Status Amphibian and Reptile Species in the Sandy River Basin

In addition to the species described above, two other special-status amphibian species have been reported or have the potential to occur in the Sandy River Basin. One of these species – Larch Mountain salamander – has the potential to be affected by the Proposed Action or alternatives and is described below. In addition, there is a single report of an occurrence of the Oregon spotted frog in Bull Run Lake in the Sandy River Basin. This report is likely erroneous because this species requires warm water wetlands, which do not exist at this lake. This species is easily observed, yet it has never been found during surveys at the Sandy River Delta where warm water wetland habitat occurs. As such, the Oregon spotted frog is considered extirpated from the area and therefore is not further addressed.

Larch Mountain Salamander (*Plethodon larselli*)

The Larch Mountain salamander is classified as a Federal species of concern and a sensitive to vulnerable species in Oregon because of its limited range and habitat (Oregon Natural Heritage Information Center 2007). This salamander species has never been found in the Sandy River Basin (Oregon Natural Heritage Information Center 2007). It primarily occurs in the Columbia River Gorge in both Oregon and Washington, but its geographic range also includes a few widely scattered sites in the Washington Cascade Mountains. There is one record from the Columbia River Basin, in the north buffer of the Bull Run Watershed.

The species was thought to be restricted to forested talus habitats, but it has been found in coniferous forests with abundant down logs and a strong component of fractured rock or pumice in the soil. The species is suspected to stay close to these talus habitats and have low dispersal capability (Crisafulli 2005). This salamander is difficult to census or study because it is principally subterranean and only occurs at the surface during mild and saturated conditions. Several aspects of its life history remain unknown, and its documented range could expand with further surveys. Appropriate habitat appears to exist in extensive talus slopes and adjacent forests near the Bull Run Reservoirs, although the majority of the talus may consist of blocks too large for salamander occupancy.

3.6 Hydrology

3.6.1 Regulatory Framework

To provide a reliable water supply, flows in the Bull Run River have been altered by diversions and impoundments. Under Oregon state law, the storage of water by an impoundment and the diversion of water from a stream or groundwater aquifer must be permitted and must be put to beneficial use. Typical beneficial uses include municipal, industrial, hydropower, domestic, and instream (i.e., fish and wildlife, aquifer recharge) uses. In 1909, the State Legislature enacted ORS 538.420, which provides that "the exclusive rights to the use of waters of the Bull Run and Lower Sandy Rivers is granted to the City of Portland."

The Bull Run River Watershed is managed as a municipal water supply source for the City of Portland and surrounding communities. The watershed is co-managed by USFS and the City under special legislation known as the Bull Run Act, USFS regulations, and formal agreements between the two agencies. The 1977 Bull Run Act, as amended, requires the USFS to consult and coordinate with the City on plans and activities for the watershed.

3.6.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and/or potentially affected by covered activities.

The primary source of water to the water supply system is the Bull Run River. The following subsections describe the climate and precipitation, surface water features, and water supply in the Sandy River Basin.

3.6.2.1 Climate and Precipitation

The Sandy River Basin has a maritime climate that is characterized by seasonally mild temperatures, wet winters, a long frost-free period, and narrow daily fluctuations in temperature. Annual precipitation generally increases from west to east and with elevation, ranging from 30 inches near the mouth of the Sandy River at Troutdale (elevation 30 ft.) to around 140 inches at Mt. Hood (elevation 11,237 ft.). The heaviest precipitation occurs from November through January, and the lowest in July and August. Table 3.6-1 summarizes precipitation variations within the watersheds of the Sandy River Basin.

Table 3.6-1 Precipitation in the Sandy River Basin by watershed

Watershed	Annual Precipitation Range (inches)	
	Low	High
Lower Sandy River	30 (at Troutdale)	62
Middle Sandy River	91	127
Upper Sandy River	70 (at the west end)	~140 [1] (near Mt. Hood summit)
Salmon River	35 (at the east end)	130 (at its source)
Bull Run River	52	143
Zigzag River	65 (at the upper Still Creek drainage)	130

Source: Sandy River Basin Partners 2005

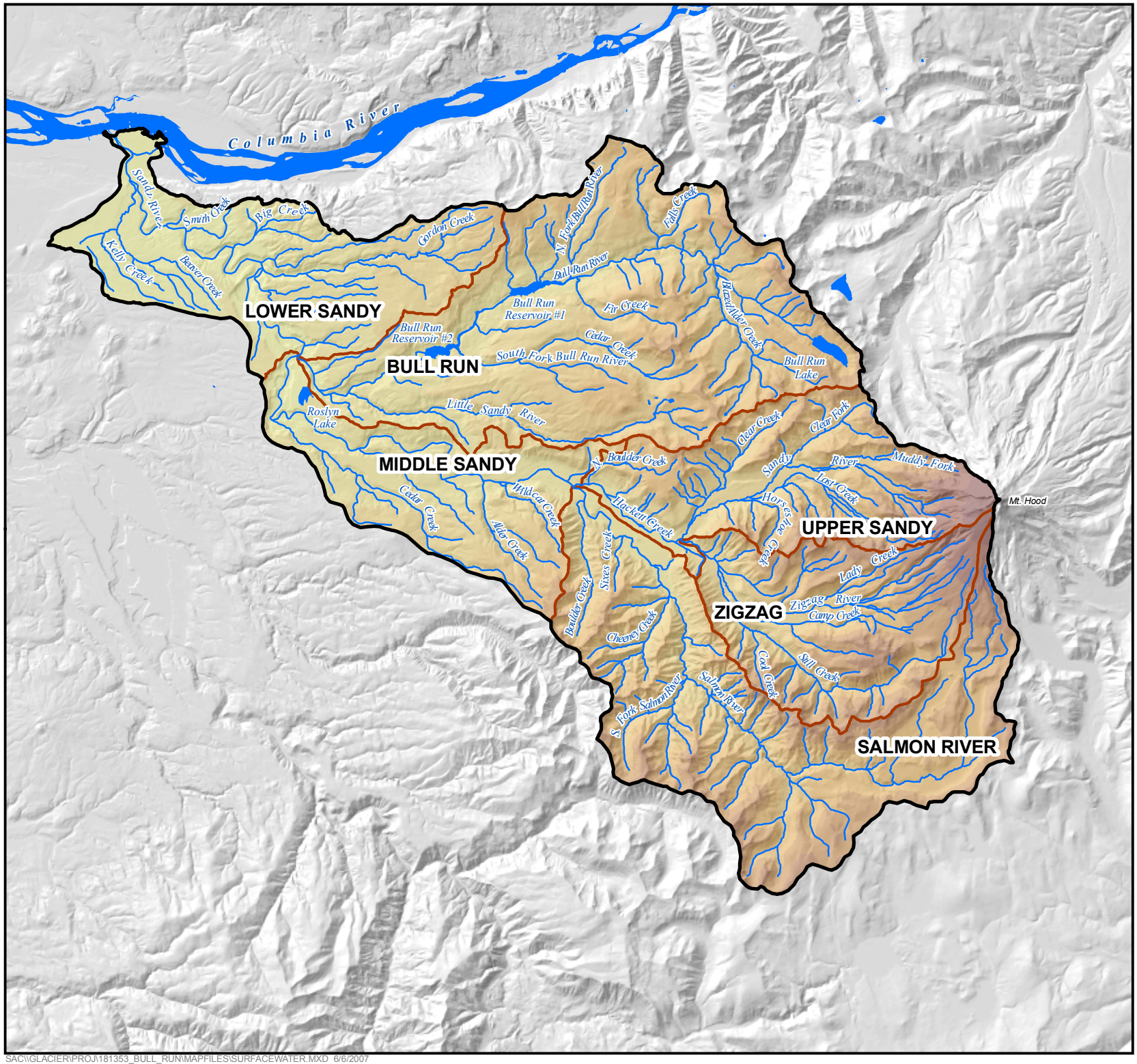
[1] ~ = Approximately

Recorded temperatures in the Sandy River Basin area range from a 30-year average monthly low of about 33°F (in January) in Portland (measured at Portland International Airport, approximately 10 mi. west of Troutdale) to a 30-year low of 22°F (in January) in Government Camp. Government Camp is approximately 56 miles southeast of Portland in the Zigzag River Watershed. Average monthly temperature highs are about 81°F (in July/August) in Portland (Portland Airport) and nearly 70°F (July) in Government Camp (Loy et al. 2001).

3.6.2.2 Surface Water Features

The Sandy River Basin drains approximately 508 square miles within the Lower Columbia River Basin and the Lower Columbia-Sandy River Basin. There are approximately 680 miles of mapped waterways within the basin, including five fifth-field hydrologic unit code watersheds: the Upper Sandy River, Middle Sandy River, Lower Sandy River, Bull Run River, and Salmon River (Figure 3.6-1). The fifth-field Salmon River Watershed encompasses the Zigzag River Watershed.

Streams originating from the northwest, west, and southwest facing slopes of Mt. Hood typically are glacial fed, whereas streams draining the south slopes are generally not glacially influenced. Glacial streams receive substantial coarse and fine sediment loads, exhibit turbid conditions due to suspended glacial flour during the summer months, and feature "flashy" hydrologic regimes, dynamic stream



Key Boundaries

- Creeks and Streams
- Lakes and Reserviors
- Sandy River Basin
- Sandy River Basin Watersheds

Projection:
State Plane Oregon North Feet
North American Datum 1983

N

0 2.5 5 Miles

0 4,023 8,046 Meters

Scale = 1:316,800

Sources: City of Portland, 2007;
The Oregon Geospatial Enterprise Office, 2007;
CH2M HILL, 2007.

Figure 3.6-1
Surface Water Features
Bull Run HCP EIS

SAC\\GLACIER\PROJ\181353_BULL_RUN\MAPFILES\SURFACEWATER.MXD 6/6/2007

channels, and cold summer stream temperatures (Sandy River Basin Partners 2005). Generally, these factors are thought to offer less stable habitat conditions for fish production than nonglacial streams (Sandy River Basin Partners 2005). Glacial tributaries in the basin include the Sandy River, Muddy Fork of the Sandy River, and Zigzag River. Clear water tributaries include the Salmon River, South Fork Salmon River, Boulder Creek, Bull Run River, Clear Creek, Camp Creek, Lost Creek, Still Creek, and Sandy River Clear Fork

The Salmon, Zigzag, and Bull Run Rivers are major tributaries to the Sandy River. The Salmon River originates on the south slope of Mt. Hood and empties into the Sandy River at River Mile (RM) 38. The Salmon River usually runs clear all year and provides significant miles of spawning and rearing habitat for anadromous and resident fish species (Sandy River Basin Partners 2005). The Zigzag River originates from Zigzag Glacier, carves its way through volcanic mudflow deposits, and terminates in alluvium near its confluence with the Sandy River. The Zigzag River is a steep-gradient stream from the headwaters to the lower 2 miles, where it transforms to a more moderate-gradient depositional area for sediment.

The Bull Run River enters the Sandy River at Dodge Park (RM 18.5) near the City of Sandy. The mainstem is approximately 25 miles long and originates from springs below Bull Run Lake (elevation 3,180 ft.), a large natural lake to the northwest of Mt. Hood. Many large tributary streams also contribute significantly to the flows produced in the Bull Run River, including the Little Sandy River, which empties into the Bull Run River at RM 3 (3 mi. below the City of Portland's Headworks Dam).

3.6.2.3 Hydrologic Regime

The Sandy River is similar to many other western Cascade Range rivers. Its flow varies greatly on a daily and seasonal basis, depending on the amount of rain falling in its watershed, the rate of snowpack and glacier melt, and withdrawals for human and agricultural consumption. Minimum stream flows in both the lower Sandy River and the Bull Run River generally occur during September or October. Peak flows in the lower Sandy and the Bull Run Rivers most often occur in December and January and are often associated with rain-on-snow events (ODFW 2002).

The monthly and seasonal trend in flows over the most recent 15-year period from 1990 to 2006 is shown in Figure 3.6-2 for the Sandy River based on measurements at the U.S. Geologic Survey (USGS) Station No. 14142500 (0.1 mi. downstream from the confluence of Bull Run River and the Sandy River) and Station No. 14137000 (0.3 mi. above the former Marmot Dam). The monthly and

seasonal trend in flows over the most recent 15-year period from 1990 to 2006 is shown in Figure 3.6-3 for the Bull Run River based on measurements at the USGS Station No. 14140000 (approximately 5 mi. upstream from the confluence with the Sandy River).

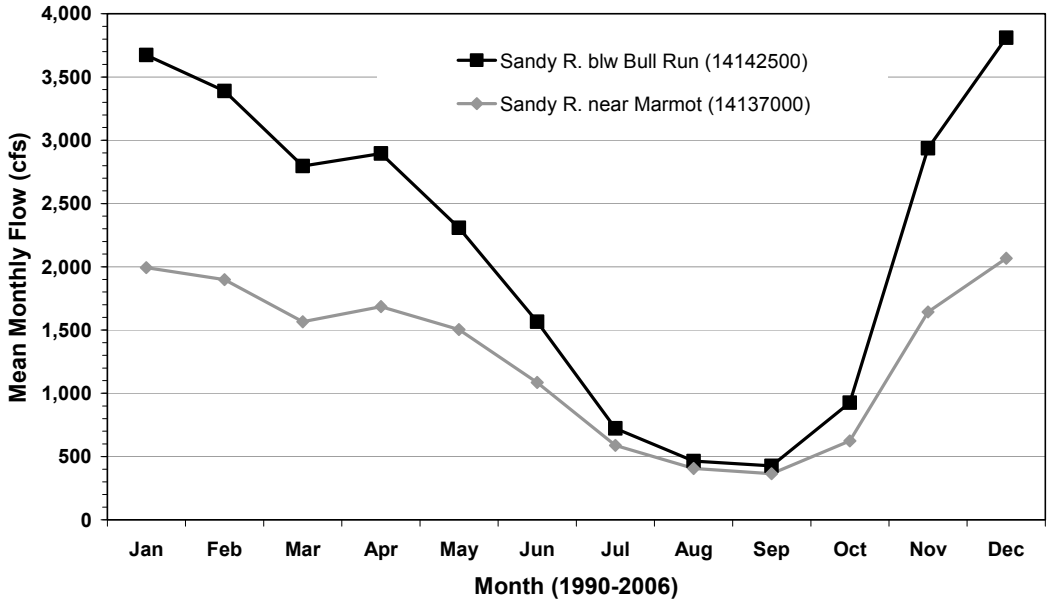


Figure 3.6-2 Mean monthly flow during the period 1990-2006 in the Sandy River below Bull Run River confluence (USGS station no. 14142500) and in the Sandy River above Marmot (USGS station no. 14137000) (Source: USGS National Water Information System).

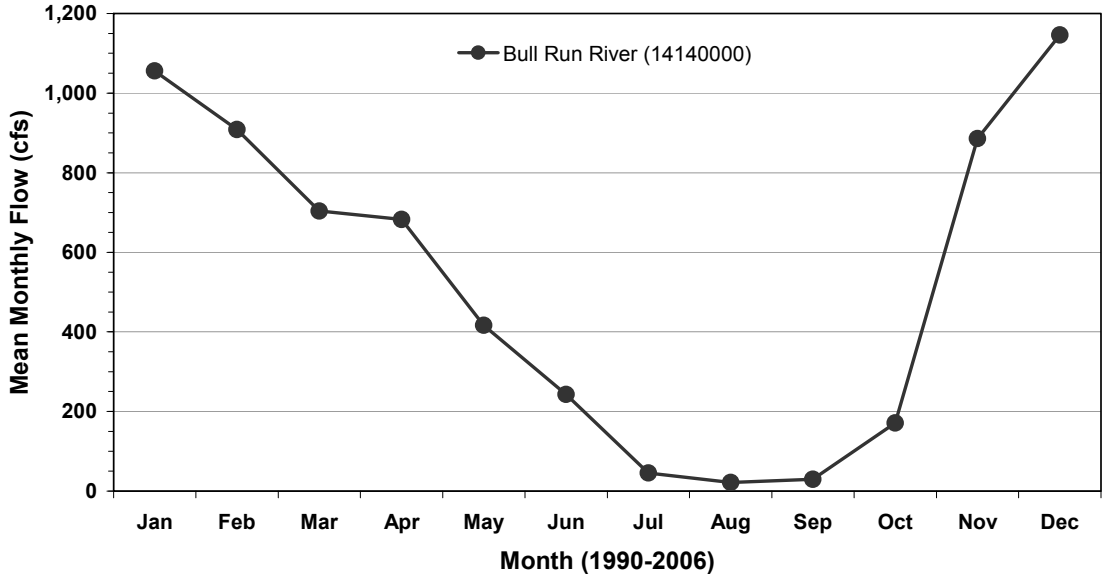


Figure 3.6-3 Mean monthly flow during the period 1990-2006 in the Bull Run River (USGS station no. 14140000) (Source: USGS National Water Information System).

Dams and diversion structures built over the past century have affected flow regimes in the Sandy River Basin. Natural discharge patterns in the Sandy River Basin are primarily altered by 1) storage and diversion of water on the Little Sandy River (Little Sandy Diversion Dam at RM 1.7 (note: this dam is being removed); 2) storage and diversion of water from the Bull Run River since 1891 to supply the City of Portland's municipal water needs (the Headworks Dam at RM 6); and 3) diversion of water from the Sandy Hatchery weir on Cedar Creek at RM 0.5, as well as withdrawal of water from Alder Creek to partially supply the City of Sandy's municipal requirements (Sandy River Basin Partners 2005). Natural discharge patterns in the lower Bull Run River are primarily altered by storage and diversion of water for the City of Portland's municipal water supply.

3.6.2.4 Water Supply

The Sandy River Basin is a water supply source for the cities of Portland and Sandy, as well as the communities along the Mt. Hood Corridor (U.S. Highway 26) and agricultural lands in the lower portion of the basin. The Bull Run Watershed has provided water to the Portland metropolitan area since 1895. This water supply is an unfiltered water source with the capacity to serve over 800,000 people. The City also owns and operates a wellfield located along the Columbia River near the Portland International Airport. The groundwater supply is used to provide water in dry years when the Bull Run supply is not enough to meet demand, and during periods when the Bull Run supply cannot be used (e.g., during the 1996 flood event).

The City provides retail and wholesale water service to the Portland metropolitan area. Retail service provides water supply to homes and businesses within the incorporated city limits of Portland. Wholesale service provides water supply to 19 cities and water districts in the Portland area, which in turn sell and distribute the water to their own customers. Some of these wholesale customers rely entirely on the City of Portland supply, and some have other sources in addition to the supply they purchase from the City.

The City of Sandy derives its water supply from Alder Creek, a tributary of the Sandy River. The unincorporated community of Corbett obtains its supply from Gordon Creek, a tributary to the mainstem Sandy River in the lower Sandy River Basin.

3.7 Water Quality

3.7.1 Regulatory Framework

Under section 303(d) of the Clean Water Act, states, territories, and authorized Indian tribes are to submit lists to EPA detailing water bodies for which existing pollution controls are insufficient to attain or maintain water quality standards. These impaired water bodies must be ranked, taking into account the severity of the pollution and the water quality standards for the water body. After submitting the list of "impaired waters," also referred to as a 303(d) list, states must develop a TMDL plan, to limit excess pollution. A TMDL plan represents the greatest pollutant load that a water body can assimilate and still meet water quality standards and designated beneficial uses. Seven stream segments in the action area were listed on ODEQ's 2002 303(d) list as being impaired due to high water temperature or E. coli. Listed reaches are summarized in Table 3.7-1.

Table 3.7-1 303(d) listed water bodies in the Sandy River Basin

Water Body	303(d) Listing Parameter	List Date	River Mile
Beaver Creek	E. coli	2002	0 – 8.3
Bull Run River	Temperature	2002	0 – 5.8
Cedar Creek	E. coli	2002	0 – 4.3
Gordon Creek	Temperature	2002	0 – 10.5
Kelly Creek	E. coli	2002	0 – 4.8
Salmon River	Temperature	1998	0 – 0.9
Sandy River	Dissolved oxygen[1]	2002	0 – 29.5
	Temperature	1998	0 – 29.5

Source: ODEQ 2007a

[1]ODEQ concluded, through subsequent data collection and analysis, that the lower Sandy River met the dissolved oxygen standards and that a total maximum daily load for dissolved oxygen was not necessary.

Within the TMDL process, states assess water quality problems, identify contributors to these problems, and establish actions needed to achieve water quality objectives. The focus is on setting TMDLs for specific pollutants throughout the watercourse. By authorities delegated from EPA, ODEQ manages the quality of Oregon's streams, lakes, estuaries, and groundwater. In 2005, ODEQ completed the Sandy River Basin total maximum daily load (TMDL) plan for the Sandy River Basin that addresses exceedances of temperature and bacteria standards.

ODEQ also developed a Water Quality Management Plan (2005). The plan provides a strategy for 1) reducing discharges from non-point sources to the required "load allocation," and 2) reducing discharges from point sources to the required "waste load allocations" described in the TMDL plan. The temperature measures include, but are not limited to, temperature control in permitted discharges, such as National Pollutant Discharge Elimination System permits, temperature control relative to dams, and establishing and protecting riparian area vegetation (e.g., shading). The Water Quality Management Plan provides an important framework guiding the development and evaluation of the Proposed Action and alternatives. Pursuant to the Water Quality Management Plan, the City prepared a draft Temperature Management Plan that provides additional detail regarding City actions for TMDL compliance (see Appendix G of the HCP).

3.7.1.1 Safe Drinking Water Act

The Safe Drinking Water Act became law in 1974; it was reauthorized in 1986 and again in August 1996. Through this Act, Congress gave the EPA the authority to set standards for contaminants in drinking water supplies. The Oregon Department of Human Services – Drinking Water Program administers and enforces drinking water quality standards for public water systems in Oregon.

3.7.1.2 Bull Run and Little Sandy Watershed Protection Legislation

The Bull Run Reserve was established in 1892. Public Law 95-200 (P.L. 95-200), enacted in 1977, revised the boundary of the federally protected area for the Bull Run River (the Bull Run Management Unit), and required the USFS to develop water quality standards for the basin, and reiterated that the primary purpose of the area was to serve as a source of high quality, raw water for the City of Portland and its wholesale customers. Amendments to P.L. 95-200 were passed by Congress in 1996 and 2001.

The 1996 Oregon Resource Conservation Act amended P.L. 95-200 and prohibited timber cutting except as needed to protect 1) water quality and quantity, and 2) operation of the City of Portland's water supply and hydropower facilities. The 2001 Little Sandy Protection Act added 2,550 acres of Federal land to the Bull Run Management Unit and extended the watershed protections that apply in the unit to these acres.

3.7.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and/or potentially affected by covered activities. The following subsections describe the surface water quality and drinking water quality of the action area.

3.7.2.1 Surface Water Quality

Salmonids and other native fish species depend on high water quality for migration, spawning, rearing, and overall viability (Sandy River Basin Partners 2005). Salmonids, in particular, require clear, cold waters for optimal health (Sandy River Basin Partners 2005). In addition, the quality of water in the Bull Run Watershed is important because it supplies drinking water for the Portland metropolitan area. Water temperature is a key factor affecting salmonid spawning and rearing in some areas of the Sandy River Basin, and also for the water supply system (Sandy River Basin Partners 2005). Other water quality parameters that are important to salmonids include turbidity, dissolved oxygen, and nutrients (Sandy River Basin Partners 2005). These parameters are briefly described below.

Temperature

Appropriate water temperatures are a critical habitat need of salmonids and the maximum temperature that salmonids can tolerate varies with species and life stage (e.g., fry, fingerling or adult). Table 3.7-2 summarizes the ODEQ temperature criteria for salmonids in the lower Bull Run River (Appendix G of the HCP, Draft Temperature Management Plan for the Lower Bull Run River). Because warm water temperatures can significantly affect salmon and steelhead production, it is important to maintain appropriate water temperatures, as described below in Table 3.7-2.

Table 3.7-2 Numeric water quality criteria for Lower Bull Run River

River Reach	Time Period	Habitat Use	7-day Average Maximum Temperature
River Mile 0 to 5.3	June 16 to August 14 August 15 to June 15	Salmonid rearing Salmonid spawning	60.8[1] (16[2]) 55.4 (13)
River Mile 5.3 to 5.8	June 16 to October 14 October 15 to June 15	Salmonid rearing Salmonid spawning	60.8 (16) 55.4 (13)

Source: ODEQ 2005

[1]Fahrenheit
[2]Celsius

Water temperatures in the lower Bull Run River during summer conditions often exceed the range of temperatures considered suitable for juvenile salmonid fish rearing (R2 Resource Consultants 1998). ODEQ has listed the lower Bull River as water quality limited for summer water temperatures. Maximum daily water temperatures in recent decades have routinely exceeded temperatures preferred for salmonid rearing and spawning in the late summer and fall (Figure 4-5 in the Bull Run HCP shows

the trend in the daily mean, maximum, and minimum water temperatures measured in the lower Bull Run River during 2001 and 2002).

Three temperature monitoring sites were established during the summer of 1995—in the lower river at RM 5.6 (below Bull Run Dam No. 2 plunge pool), at RM 3.6 (Larson's Bridge), and at RM 1.6 (immediately upstream of the Bull Run Powerhouse)—to characterize longitudinal trends in surface water temperatures, as listed in Table 3.7-3. Mean daily water temperature at the upstream site (RM 5.6) ranged between 57°F (13.9°C) and 67.8°F (19.9°C) while averaging 60°F (15.6°C) during the late summer and early fall monitoring period (Sandy River Basin Partners 2005).

Table 3.7-3 Longitudinal comparison of surface water temperatures in the Lower Bull Run River between Dam No. 2 and the Bull Run Powerhouse (based on July-September 1995 monitoring data)

Monitoring Sites	Low	Mean Daily	High
RM 5.6 – Water Temperature	57[1] (13.9[2])	60.1 (15.6)	67.8 (19.9)
RM 3.6– Water Temperature	60.3 (15.7)	65.3 (18.5)	71.9 (22.2)
RM 1.6– Water Temperature	61.1 (16.2)	65.1 (18.4)	73.9 (23.3)
River Discharge (cfs[3])	3.0	5.0	29.0

Source: Sandy River Basin Partners 2005

[1]Fahrenheit
[2]Celsius
[3]Cubic feet per second

Water temperatures occasionally exceed standards for salmonid fish spawning and rearing at certain times of year in some reaches of the basin. Specifically, the lower Salmon River, the mainstream Sandy River from the former Marmot Dam to its mouth, the lower Bull Run River below Dam No. 2, and much of Gordon Creek have water temperatures that can exceed ODEQ's standards for salmonid fishes (ODEQ 2004). In general, tributaries in the upper portion of the Sandy River Basin maintain cooler temperatures than the mainstem of the major rivers (Salmon, Sandy, and Bull Run) because of their higher elevations (cooler air temperatures) and their narrower channel widths that afford more shade from riparian trees (Sandy River Basin Partners 2005).

Turbidity

Turbidity is a measure of the degree to which the water loses its transparency because of the presence of suspended particulates (the more total suspended solids in the water, the cloudier it appears and the

higher the turbidity). Turbidity can be caused by sediments from erosion or intense storm events, which can disturb solids and suspend them in the water column (Sandy River Basin Partners 2005).

The Upper Sandy River Watershed originates high on the western slopes of the Cascade Mountains and receives a considerable amount of stream flow as a result of snowpack and glacial ice accumulations on Mt. Hood (Sandy River Basin Partners 2005). During the summer dry season, glacial runoff releases large quantities of sediments into the Upper Sandy River and Muddy Fork, resulting in increases in turbidity downstream (Sandy River Basin Partners 2005).

Turbidity can be harmful for fish because suspended solids absorb heat from the sun, increasing temperatures, and thereby potentially reducing the concentration of oxygen in the water (EPA 2006). In water supply systems, the higher the turbidity, the higher the health risk to consumers because contaminants (e.g., virus or bacteria) can become attached to the suspended solids (EPA 2006). Water quality data for the Sandy River Basin have been only sporadically collected; the exceptions are the Bull Run River Watershed (where water quality is extensively monitored because it is a municipal water source) and an ambient water quality sampling site at the mouth of the Sandy River (Troutdale Bridge, monitored by ODEQ) (Sandy River Basin Partners 2005). The data collected over the years generally indicate that water quality in the Sandy River Basin is good, but there has been evidence of elevated stream temperatures, chemical contamination, and increased sediment loading and deposition at some locations (Sandy River Basin Partners 2005).

Dissolved Oxygen

Dissolved oxygen (DO) refers to oxygen gas that is dissolved in water by diffusion from the atmosphere, aeration of water, and as a product of photosynthesis. DO is necessary to maintain aerobic conditions in surface waters, and it is considered a primary indicator for assessing the suitability of surface waters to support aquatic life (EPA 2006). Warm water is much less capable of holding DO than cool water (EPA 2006). In addition, cloudy days and turbidity can limit DO levels because they limit the amount of light available for photosynthesis (EPA 2006). Based on available data, ODEQ has not identified any stream segments within the Sandy River Basin as water quality-limited due to dissolved oxygen levels (Sandy River Basin Partners 2005).

Nitrogen and phosphorus are essential for life and are widespread in the environment. However, excess nutrient loading can cause nutrient toxicity and eutrophication in surface waters (EPA 2006). Nutrient toxicity can result from un-ionized ammonia or nitrate (EPA 2006). Salmonids are particularly sensitive to un-ionized ammonia and nitrate toxicity can be a concern for drinking water because nitrates are associated with chronic human health problems (EPA 2006).

Eutrophication is the excessive and undesirable growth of algae and aquatic plants caused by excessive levels of nutrients. Algae can deplete the oxygen needed by other aquatic species. High levels of algal growth can cause poor water quality, such as low dissolved oxygen (EPA 2006). Excess nutrient loading is typically caused by non-point source pollution, including failing septic systems and agricultural and urban runoff (EPA 2006). Based on available data, ODEQ has not identified any stream segments within the Sandy River Basin as water quality-limited due to nutrient levels (Sandy River Basin Partners 2005).

Nutrients

Salmon die after spawning, and the nutrients in their bodies are deposited into the ecosystem. Fish carcasses are an important source of nutrients and they are often intentionally placed in waterways to enhance instream productivity and to benefit fish. However, excess nutrients from decaying fish carcasses, mainly nitrogen, phosphorus, and carbon, can increase the amount of contributing nutrients for phytoplankton, algae, and periphyton growth in the watershed (R2 Resource Consultants 1998). This problem has not been observed with any of the carcass placement experiments conducted to date (Bilby et al. 1998; Pearsons et al. 2003). The Washington Department of Fish and Wildlife (2001) and Pearsons et al. (2003) found the nutrients provided by salmon carcasses were quickly taken up within the stream reach and little, if any, of the nutrients were transported downstream out of the reach.

3.7.2.2 Drinking Water Quality

The City monitors approximately 200 regulated and unregulated contaminants in drinking water, including pesticides and radioactive contaminants. The only known contaminants of concern for the Bull Run water supply are naturally occurring microbial contaminants such as *Giardia lamblia*, *Cryptosporidium*, fecal coliform bacteria, and total coliform bacteria (Drinking Water Quality Report, City of Portland 2007). *Giardia lamblia* and *Cryptosporidium* are found in virtually all freshwater ecosystems. *Cryptosporidium* has been infrequently detected in the Bull Run River in very low levels. As of this printing, *Cryptosporidium* has not been detected in the Bull Run water supply since August 2003. The City does not treat the water for *Cryptosporidium*. The City's treatment program is designed to kill *Giardia* and coliforms coming from the Bull Run. Coliforms also form in the City's water distribution system, outside of the Bull Run. However, the City's existing operations and treatment regime addresses coliform growth sufficiently to allow Portland to meet all state and Federal drinking water regulations.

3.8 Fish

3.8.1 Regulatory Framework

3.8.1.1 Federal Endangered Species Act

The 1973 Endangered Species Act (16 U.S.C. 1531-1544) provides for the conservation of ecosystems (both through Federal action and by encouraging the establishment of state programs) upon which threatened and endangered species depend. The ESA is enforced by NMFS (with jurisdiction over anadromous fish) and by the USFWS (with jurisdiction over resident fish). See Subsection 1.1.2.1, Endangered Species Act, for a detailed description.

3.8.1.2 Oregon Endangered Species Act

The Oregon Endangered Species Act was enacted in 1987. It requires the "conservation" of listed species, and defines "conservation" as "the use of methods and procedures necessary to bring a species to the point at which the measures provided under ORS 496.171 to 496.182 (Oregon ESA) are no longer necessary. Such methods and procedures include, but are not limited to, activities associated with scientific resource management such as research, census taking, law enforcement, habitat acquisition and maintenance, propagation and transplantation." When a species is listed, the Oregon Fish and Wildlife Commission must establish "quantifiable and measurable guidelines," otherwise known as survival guidelines, "that it considers necessary to ensure the survival of individual members of the species."

Fish species listed under the Oregon ESA also are considered in this EIS. In addition, the Oregon ESA applies to actions of state agencies on state-owned or leased lands, including issuance of permits to alter streambeds under the jurisdiction of the Oregon Department of State Lands.

3.8.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with or potentially affected by covered activities.

The following subsections provide an overview of the habitat conditions in the Sandy River Basin, a description of the nine fish species addressed in the Bull Run HCP, and a description of the one special-status fish species not addressed in the HCP. Special-status fish species known to occur in the Sandy River Basin are listed in Table 3.8-1. The table also indicates which species are proposed for coverage under the Bull Run HCP and other species that are addressed in the HCP. In addition to the

species listed in this table, the HCP includes conservation measures for two species, rainbow trout and western brook lamprey, which do not have special Federal or state status.

Table 3.8-1 Special status fish species in the Sandy River Basin

Species[1]	Species Status[2]	Covered Under the Bull Run HCP	Conservation Measures Included in the Bull Run HCP
Columbia River chum salmon (*Oncorhynchus keta)*	FT, SC	✓	✓
Lower Columbia River coho salmon (*Oncorhynchus kisutch)*	FT, SE, ONHP List 1	✓	✓
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha)*	FT, SC, ONHP List 1	✓	✓
Lower Columbia River steelhead (*Oncorhynchus mykiss* ssp.)	FT, SC, ONHP List 1	✓	✓
Malheur mottled sculpin (*Cottus bairdi* ssp.)	SOC, SC		
River lamprey (*Lampetra ayresi)*	SOC		✓
Pacific lamprey (*Lampetra tridentata)*	SOC, SV		✓
Coastal cutthroat trout (*Oncorhynchus clarki clarki)*	SOC, SC		✓

[1]Source: Oregon Natural Heritage Program 2001 (as found in ODFW 2002)

[2]Sources: ORNHIC 2007; USFWS 2006; USFWS 2005; ODFW 2004; ODFW, 1997

Federal:
FT = Federally Threatened Species
SOC = Federal Species of Concern

State:
SE = State Endangered Species
SC = State Critical Species
SV = State Vulnerable Species

Key to Oregon Natural Heritage Program (ONHP) List of rare species in Oregon:
1 = threatened or endangered throughout range
2 = threatened or endangered throughout Oregon, but common elsewhere
3 = review list (more information is needed)
4 = watch list (currently stable)

Species status is described as it is classified by NMFS, USFWS, and the ODFW. Under the Federal and state Endangered Species Acts, species can be listed as threatened or endangered. Threatened is the classification provided to an animal or plant likely to become endangered within the foreseeable future

throughout all or a significant portion of its range. Endangered is the classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range. Species also can be defined as "species of concern." Species of concern is an informal term, and it not defined in the Federal ESA. It commonly refers to species that are declining or appear to be in need of concentrated conservation actions.

3.8.2.1 Fish Habitat in the Sandy River Basin

The Sandy River Basin is located adjacent to the Cascade Range of northwestern Oregon, just east of the Portland metropolitan area. The Sandy River Basin makes up a relatively small part of the Lower Columbia portion of the much larger Columbia River Basin. The Sandy River Basin drains approximately 508 square miles (325,000 ac.). The river and many of its tributaries originate high on the slopes of Mt. Hood and flow about 56 miles in a northwesterly direction to join the Columbia River near Troutdale at Columbia River Mile (RM) 120.5.

The Sandy River Basin drains approximately 508 square miles within the Lower Columbia River Basin and the Lower Columbia-Sandy River Basin. There are approximately 680 miles of mapped waterways within the basin, including five fifth-field hydrologic unit code watersheds: the Upper Sandy River, Middle Sandy River, Lower Sandy River, Bull Run River, and Salmon River (see Figure 3.6-1). The fifth-field Salmon River Watershed encompasses the Zigzag River Watershed.

The Sandy River Basin supports a diverse assemblage of native and introduced fish species. The basin contains about 170 stream miles of habitat currently used by anadromous fish (Sandy River Basin Partners 2005). The Upper Sandy River Watershed contains the most stream miles of currently accessible anadromous fish habitat – 44 miles (26 percent of the basin total), and the Bull Run River Watershed contains the least – 8 miles (5 percent of the basin total) (Sandy River Basin Partners 2005).

Historically, environmental conditions in the basin have met or exceeded conditions suitable for use by salmonid fishes. In general, water quality conditions in the Sandy River Basin are good, and are suitable for supporting salmonids. An analysis of key environmental factors affecting anadromous fish production in the basin indicates that overall water quality (with the exception of temperature) is not a key factor that has significantly affected production (Sandy River Basin Partners 2005). Additional water quality information can be found in Subsection 3.7, Water Quality. Current conditions, however, have been degraded from historical conditions, resulting in an overall reduction in the habitat's potential to support anadromous fish production. In particular, the loss of stream habitat diversity,

elevated water temperatures, and reduced food resources have contributed to this reduction (Sandy River Basin Partners 2005).

In a diverse salmonid fish stream, ample amounts of pool, riffle, and glide-type habitats and side-channel areas are available for rearing and refuge (Sandy River Basin Partners 2005). Under current conditions in the basin, riffle-type habitat dominates, and pool and side-channel habitats are relatively low in abundance (Sandy River Basin Partners 2005). The reduced frequency of pool and side-channel habitat is likely the result of low amounts of in-channel, large, woody debris (important elements of pool formation) and physical channel manipulations (e.g., channelization, channel confinement, realignment, or bank armoring) that have occurred as a result of development or flood control measures (Sandy River Basin Partners 2005).

Several other habitat related changes (e.g., passage barriers or obstructions, flow diversions) have contributed to reduced anadromous fish production in some of the watersheds or for particular species (Sandy River Basin Partners 2005). For example, ODFW (1997a) concluded that juvenile fish screens and the bypass facility at the former Marmot Dam were not in compliance with agency criteria and that some levels of impingement, entrainment, and migration delay probably occur. Dams constructed on the Bull Run River (RM 5.8) and Little Sandy River (RM 1.7) and a weir constructed at the Sandy Hatchery, in the Middle Sandy River Watershed, prohibit passage of anadromous fish upstream. In addition, flow diversions, such as from the Bull Run River for municipal water supply or at the former Marmot Dam for hydropower generation, reduce flows in certain river sections in the basin (Sandy River Basin Partners 2005). The hydroelectric facilities on the Little Sandy River (Marmot and Little Sandy Dams) are in the process of being removed, and habitat is being restored.

Water temperatures exceed standards for salmonid fish spawning and rearing at certain times of the year in some reaches of the basin. Specifically, the lower Salmon River, the mainstream Sandy River from the site of the former Marmot Dam to its mouth, the lower Bull Run River below Dam 2, and much of Gordon Creek have water temperatures that can exceed ODEQ standards for salmonid fishes (ODEQ 2005). For additional information regarding water quality standards exceedances see Subsection 3.7.2.1, Surface Water Quality.

In addition, food resources, particularly for rearing juvenile salmonids, are thought to be reduced from historical conditions (Sandy River Basin Partners 2005). The loss of such resources is mainly due to significant reductions in the number of spent adult salmon carcasses that once provided a considerable source of nutrient levels to the stream systems (Sandy River Basin Partners 2005). Loss of up to

50,000 carcasses annually represents a considerable reduction in carbon, nitrogen, and phosphorus for the aquatic system (Sandy River Basin Partners 2005).

Section 4.3 of the Bull Run HCP provides specific habitat information for the following watersheds: Lower Sandy River, Middle Sandy River, Upper Sandy River, Salmon River, Zigzag River, and the Bull Run River.

3.8.2.2 Fish Species in the Sandy River Basin

Fish Species Proposed for Coverage under the Bull Run HCP

The fish species proposed for coverage under the Bull Run HCP are the Lower Columbia River Chinook salmon (fall and spring), Lower Columbia River steelhead, Lower Columbia River coho salmon, and Columbia River chum salmon (Table 3.8-1). For each of these species, population status, habitat needs, and distribution are described below. Life histories and historical distribution for each species are described in Section 5.4 of the Bull Run HCP.

Lower Columbia River Chinook Salmon (Fall and Spring) (*Oncorhynchus tshawytscha*)
Fall and spring Chinook salmon are currently state-listed as a sensitive species and federally listed as threatened under the ESA. NMFS (1995) cites several factors for decline across the range of Chinook salmon, including water diversions for agriculture, flood control, domestic use, and hydropower purposes. Other factors include forestry, agriculture, mining, urbanization, and overexploitation.

Fall and spring Chinook salmon that occur in the Sandy River Basin are included in the Lower Columbia River evolutionary significant unit (ESU). Chinook salmon in the Sandy River Basin are ocean-type fish, meaning they typically spend one year or less rearing in fresh water (Cooney et al. 2003). However, if environmental conditions are not conducive to subyearling outmigration, ocean-type Chinook salmon juveniles may remain in fresh water for the entire first year after hatching (Myers et al. 1998; NMFS 2003). Juvenile fall Chinook salmon are dependent on estuaries and associated wetlands as nursery areas before they migrate to the open ocean. Wetlands play a vital role in providing feeding opportunities and offering protection from predators (Sandy River Basin Partners 2005). Ocean residence varies, but most Chinook salmon spend between 3 and 4 years in salt water before returning to spawn in fresh water (Sandy River Basin Partners 2005).

Adult fall Chinook salmon begin to enter the Sandy River Basin in August and are probably present through February in small numbers (ODFW 1997a). Peak spawning occurs from October through December, and spawning distribution appears to be related to flow conditions in the basin (ODFW 1997a). Juvenile emigration occurs from March through June (ODFW 1997a). In the lower Bull Run

River, this species spawns in fall, emerges from the gravel and rears in the winter and late spring, and emigrates from the Bull Run Watershed by early summer.

Columbia River spring Chinook salmon bound for the Sandy River begin entering the Sandy River Delta as early as February, but more commonly in April and May (ODFW 1997a). Peak migration over the Marmot Dam into the upper Sandy River Basin usually occurs in June, with a smaller peak occurring in September (ODFW 1997a). Migration into the upper Basin subsides in July and August, probably due to a seasonal increase in water temperature and decrease in instream flow (ODFW 1997a). Spawning occurs primarily in August through October, peaking in September (ODFW 1997a). Fry emergence typically occurs in middle to late winter, followed by a downstream migration to large mainstem areas for rearing (ODFW 1997a).

The Sandy River Working Group, composed of agencies and nongovernmental groups interested in restoring fish runs in the Sandy River Watershed, identified anchor habitats for salmon and steelhead populations (Sandy River Working Group 2007). Anchor habitats are defined as distinct stream reaches that currently harbor specific life history stages of salmon and steelhead to a greater extent than the stream system at large. All five anchor habitat reaches for fall Chinook are located in the Lower Sandy River Watershed. Three anchor habitat reaches occur on the mainstem Sandy River and two are on the lowermost ends of Trout and Gordon Creeks. Trout and Gordon Creeks support fall Chinook spawning and may serve as refuge areas for adult fish during high-flow events (ODFW 2001).

Because fall Chinook have not been observed upstream of the former Marmot Dam in recent years, the Sandy River Basin Agreement Technical Team determined that the species is concentrated primarily in the mainstem Sandy River below Marmot Dam. The current distribution has probably been affected by several factors, such as ineffectiveness of the fish ladder at the former Marmot Dam (from about 1913 to 1933), seasonal low flows in the Sandy River below the former Marmot Dam and in the Bull Run River, and ODFW egg taking at the former Marmot Dam. The extent to which these conditions will change after the recent removal of Marmot dam is unknown.

Spring Chinook anchor habitat is generally located in the upper Sandy River Basin upstream of Cedar Creek (Sandy River Working Group 2007). Two reaches in the mainstem Sandy River from approximately RM 24 (2 mi. upstream from the confluence with Cedar Creek) to the Salmon River confluence were identified as anchor habitat. These reaches are in the Middle Sandy River Watershed. Other identified anchor habitats for spring Chinook are all of the mainstem Salmon River up to Final Falls (RM 14), the Sandy River from the Salmon River confluence to the Zigzag River, the lower end

of Clear Fork Creek in the Upper Sandy River Watershed, and the lower end (downstream of Cool Creek) of Still Creek.

Spring Chinook in the basin utilize the mainstem Sandy River from the mouth upstream to the former Marmot Dam for migration and rearing. Recent data also show spring Chinook use in the lower Sandy River (personal communication with D. Tonnes, National Marine Fisheries Service, Fisheries Biologist, 2005). Sandy River spring Chinook salmon spawn primarily upstream of Marmot Dam, with most spawning occurring in the Salmon River up to Final Falls (near RM 14) and in Still Creek from its confluence upstream about 3 miles (ODFW 1997a). Spawning also occurs in the Zigzag River, the upper Sandy River (mostly above Clear Creek), and the lower reaches of Clear Creek and Lost Creek. Spawning also has been documented in the lower Bull Run River (R2 Resource Consultants 1998). Spawning probably occurs in the mainstem Sandy River side channels and tributaries when sufficient flows exist. Additionally, the Sandy River and associated tributaries above the former Marmot Dam support migration and rearing of juvenile and adult life forms.

In the Bull Run Watershed, fall and spring Chinook salmon currently can use about 7.5 stream miles of habitat. Of this amount, approximately 5.8 miles occur in the lower Bull Run River downstream of the Headworks and 1.7 miles occur in the Little Sandy River. Even though 7.5 stream miles are accessible in the Bull Run Watershed, spring Chinook do not currently use this entire habitat. On the mainstem Bull Run River, Chinook (both spring and fall) have not been observed upstream of Larson's Falls at RM 4.3 on the Bull Run River. The falls are passable at relatively small flows, but Chinook tend to stay in the lower river.

Lower Columbia River Winter-run Steelhead (*Oncorhynchus mykiss)*

Winter steelhead are currently state-listed as a sensitive species and federally listed as threatened under the ESA. Winter-run steelhead are included in the Lower Columbia River ESU. NMFS identified destruction and modification of habitat, overutilization for recreational purposes, and natural and man-made factors as the primary reasons for the decline of west coast steelhead (NMFS 1998). Specifically for the Lower Columbia River ESU, NMFS (1998) identified the following factors as contributing to the decline of steelhead: competition and interbreeding with hatchery fish, impeded access to habitat, hydropower development, logging, predation, and harvest.

Important steelhead habitat reaches were identified in the following watersheds:

- Lower Sandy River: lower end of Trout Creek

- Middle Sandy River: mainstem Sandy River from Bull Run confluence to RM 24 (2 mi. upstream of the mouth of Cedar Creek), mainstem Sandy River from the former Marmot Dam to the mouth of the Salmon River, and the lower end of Wildcat Creek
- Upper Sandy River: mainstem Sandy River from the Salmon River confluence to the Zigzag River and the lower ends of Clear Fork and Lost Creeks
- Bull Run River: lower Little Sandy River downstream of the Little Sandy Dam
- Salmon River: lower Salmon River downstream of Boulder Creek and the lower ends of Boulder Creek, Sixes Creek, and the South Fork Salmon River
- Zigzag River: the lower 10 miles of Still Creek

The majority of suitable spawning habitat is located upstream of the former Marmot Dam in the Salmon River and its tributaries, and in Still Creek (PGE 2002). Spawning habitat is also present in Clear Creek, Clear Fork, Lost Creek, Horseshoe Creek, Zigzag River and Camp Creek (personal communication with D. Bishop, Mt. Hood National Forest, Fisheries Biologist, 2004). Peak passage over Marmot Dam usually occurs in March and April (PGE 2002), with peak spawning occurring mid-March through mid-May (PGE 2002).

Sandy River Basin winter steelhead usually spend 2 years in the ocean, but 3-year ocean residence is common (ODFW 1997a). Native winter steelhead spawning and rearing in the Sandy River primarily occurs upstream of the former Marmot Dam. Lower basin tributaries (below the former Marmot Dam) that support additional winter steelhead production include the Bull Run River and Gordon, Trout, and Buck Creeks (PGE 2002). Juvenile winter steelhead are likely present year round throughout most of the Sandy River mainstem in both the upper and lower portions of the basin. Natural production in the Bull Run and Little Sandy Rivers and in Cedar and Alder Creeks is limited by a lack of fish passage into the upper reaches of the streams.

The following key environmental factors may affect abundance and productivity of steelhead in the lower Bull Run River (R2 Resource Consultants 1998):

- Dam and culverts block access to potential upstream spawning habitat
- High water temperatures during summer may affect juvenile fish growth and survival
- Sustained summer low flows may reduce the amount of instream habitat suitable for use by juvenile steelhead

- Gravel in the lower river suitable for spawning is lacking or absent
- Rapid, short term flow fluctuations may strand or displace juvenile steelhead

In the Bull Run Watershed, steelhead currently use about 7.5 stream miles of stream habitat. Fish passage is blocked at RM 5.8 on the lower Bull Run River and at RM 1.7 on the Little Sandy River. Other tributaries to the lower Bull Run River have limited productivity potential for anadromous fish because of steep gradients or natural waterfalls (City of Portland 2002). Additionally, a culvert barrier in Walker Creek blocks access to about 800 feet of this lower Bull Run River tributary (City of Portland 2002).

Lower Columbia River Coho Salmon (*Oncorhynchus kisutch)*

Lower Columbia River coho salmon are currently listed as endangered under the Oregon ESA and threatened under the Federal ESA. Coho are included in the Lower Columbia River ESU. NMFS (1995) identified the following factors as contributing to the decline of coho salmon in the Lower Columbia River ESU: habitat degradation from logging, water withdrawals and unscreened diversions, agricultural activities, competition and interbreeding with hatchery fish, urbanization, overharvest, stream channelization, adverse ocean conditions over the last two decades, dams, and inadequate regulatory mechanisms.

Currently, the Sandy River Basin supports both an early hatchery run of coho—with peak presence occurring in September and October—and a late wild run generally peaking from September through November (ODFW 1997a). Overall, peak spawning activity in the Sandy River Basin occurs in late October through November, with very few fish observed on the spawning grounds after December (ODFW 1997a). Duration of egg incubation and fry emergence of coho salmon is greatly affected by water temperature, but generally takes between two and three months (ODFW 1997a). Emergence primarily occurs from February through April and peaks in March (PGE 2002).

Following their emergence, juvenile coho salmon typically seek stream margin habitats and backwater pools for initial rearing (ODFW 1997a). As they continue to grow in size, juveniles seek low velocity pool and off channel habitats for summer and winter rearing. Juvenile coho favor slack water habitats with complex large wood for protection from winter freshets. Juvenile coho in the Sandy River typically migrate to the ocean at about 12 to 14 months of age (ODFW 1997a). Coho salmon in the Lower Columbia River ESU generally rear in the ocean for two summers and return as 3 year olds.

The majority of the coho anchor habitat reaches are located in the Upper Sandy River Watershed upstream of the confluence of the Sandy and the Salmon Rivers. One anchor habitat reach is on lower

Gordon Creek, which is in the Lower Sandy River Watershed. The mainstem Salmon River up to Cheney Creek and the lower portions of Weeburn, Sixes, and Cheney Creeks are all anchor habitat reaches in the Salmon River Watershed. A portion of Still Creek in the Zigzag River Watershed and portions of Lost Creek and Clear Fork Creek in the Upper Sandy River Watershed make up the remaining anchor habitat reaches for coho salmon.

The majority of suitable coho spawning and rearing habitat in the Sandy River is located upstream of the former Marmot Dam in the mainstem Sandy River, in the Salmon River and its tributaries below Final Falls, and in Still Creek (ODFW 1997a; PGE 2002). Lower Sandy River Basin tributaries that could support coho salmon include Cedar, Trout, Beaver, Gordon, and Buck Creeks (ODFW 2002) and the Bull Run River. Natural production in the Bull Run River and in Cedar Creek is limited by blocked fish passage into the upper reaches of the streams. Additional small tributaries may support coho production in some years. Many of the coho entering lower basin tributaries below the former Marmot Dam are likely strays from the Sandy Hatchery (ODFW 1997a).

In the Bull Run Watershed, coho salmon have access to about 7.5 stream miles of stream habitat. Of this total, approximately 5.8 miles occur in the lower Bull Run River downstream of the Headworks, with an additional 1.7 miles in the Little Sandy River.

Columbia River Chum Salmon (*Oncorhynchus keta)*

Columbia River chum salmon are currently state-listed as a sensitive species and federally listed as threatened under the ESA. The following factors have likely contributed to the decline in chum salmon population: variations in the freshwater and ocean environments, artificial propagation, gravel mining operations, channelization, and siltation associated with road construction and logging (Johnson et al. 1997; Kostow 1995).

Chum salmon are reported to spawn in shallow, slow velocity streams and side channels (Johnson et al., 1997). Preferred spawning areas include groundwater fed streams or at the head of riffles (Grette and Salo 1986). Salo (1991) reported that chum salmon migrate upstream during October and November, and spawning can continue into December (Cooney and Jacobs 1994). In general, upstream chum migration can occur quickly, with transport rates of 30 miles per day. The length of embryo incubation is influenced primarily by water temperature.

Juvenile chum salmon rear in fresh water for a period of a few days to several weeks before migrating downstream to salt water (Grette and Salo 1986). Juvenile chum have longer rearing times in estuaries than most salmon, and estuarine survival appears to play a major role in determining subsequent adult

return to fresh water (Johnson et al. 1997). Juvenile chum salmon migrate from fresh water shortly after emergence and rear primarily in estuarine waters for a period of up to several months. Fry may remain near the mouth of their natal river after entering the estuary, or they may disperse rapidly throughout the estuarine system into tidal creeks and sloughs (Johnson et al. 1997).

There is little information on the historical distribution of chum salmon in the Sandy River. The Sandy Basin chum salmon population is for all practical purposes extinct (ODFW, 2005). The few fish that have been observed in the Sandy River are believed to be strays from healthier runs in nearby Washington streams in the Columbia River ESU (ODFW, 2005).

Fish Species Addressed in the Bull Run HCP

The fish species addressed in the HCP are rainbow trout, coastal cutthroat trout, Pacific lamprey, river lamprey, and western brook lamprey (Table 3.8-1). For each of these species, population status, habitat needs, and distribution are described below. Life histories and historical distribution for each species are described in Section 5.4 of the Bull Run HCP.

Rainbow Trout (*Oncorhynchus mykiss*)

Rainbow trout are not state-listed or federally listed as a sensitive species. Rainbow trout are the same species as steelhead, but they are the resident form. Habitat preferences for rainbow trout in the lower Bull Run Watershed and the Sandy River Basin are the same as for steelhead. Populations of rainbow trout are found in Bull Run Reservoir 1 and their habitat preferences are similar to those described below for cutthroat trout. The City does not have fish screens on its water intake towers in Bull Run Reservoir 1 or 2. Entrainment of rainbow trout in Reservoir 1 is likely occurring at a very low rate, which is not negatively affecting the reservoir population of fish. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which will support this conclusion (see Section 8.4.1 Rainbow Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1 on rainbow trout).

Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)

Coastal cutthroat trout are currently state-listed as a sensitive species and federally listed as a species of concern. They were proposed for Federal listing in March 1999, but were not listed because local conservation and recovery work was undertaken to reduce mortality resulting from direct and incidental harvest and to reduce hatchery production of anadromous life history forms in the Lower Columbia River. Other factors that supported the conclusion not to list this species included changes in

forest management regulations and an improved understanding of the ability of freshwater forms to produce anadromous progeny (USFWS 2002).

Resident cutthroat trout are widely distributed in the Sandy River Basin, but anadromous migratory cutthroat trout behavior and distribution in the basin are poorly documented and understood. Cutthroat trout generally prefer small tributary streams for spawning and rearing (PGE 2002). Coastal cutthroat trout spawning periods vary from late winter to summer, depending on life history type (ODFW 1997a).

Resident cutthroat trout populations likely occur in most tributary streams of both the lower and upper portions of the basin (ODFW 1997a). Based on recent counts at the former Marmot Dam, it is assumed that no anadromous cutthroat trout currently migrate into the upper basin. Isolated populations of resident cutthroat trout above natural and anthropogenic passage barriers represent an important genetic resource to individual and basin wide populations. A genetically distinct population of adfluvial cutthroat trout still exists in Bull Run Lake and Bull Run Reservoir 2 (ODFW 1997a).

The City does not have fish screens on its water intake towers in Bull Run Reservoir 1 or 2. Entrainment of cutthroat trout in the reservoirs is likely occurring at a very low rate, which is not negatively affecting the reservoir populations of fish. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which will support this conclusion (see Section 8.4.2 Cutthroat Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1 and 2 on cutthroat trout).

Pacific Lamprey (*Lampetra tridentata*)

Pacific lamprey are currently state-listed as a sensitive species and federally recognized as a species of concern. Freshwater habitat degradation is likely the most significant threat to Pacific lamprey populations. Habitat issues include streambed siltation, water pollution, hydrologic modifications, and development in or above rearing areas (Kostow 2002). Migrating adult lamprey have difficulty negotiating fish ladders, thus in-channel structures, dams, and perched culverts could inhibit access to spawning habitats. In addition, lamprey are thought to be highly susceptible to injury and mortality at fish screens because of their small size.

Pacific lamprey are an anadromous and parasitic species. The parasitic phase is restricted to the marine environment, where lamprey can attach to large fish and marine mammals. Adult lamprey leave the ocean to spawn in freshwater streams, sometimes traveling several hundred miles to the headwaters of streams (Wydoski and Whitney 1979). They overwinter in fresh water and spawn from February

through May in Oregon (Kostow 2002) when water temperatures are between 50 and 59°F (10 and 15°C) (Close et al. 1995). Flowing water in low gradient sections where gravel is deposited is preferred for spawning (Close et al. 1995). Nest sites are constructed in pools and in riffles over gravel with a mix of pebbles and sand (Kan 1975). As such, flow is an important spawning requirement for Pacific lamprey. Spawning Pacific lamprey are often observed during steelhead spawning surveys, and they spawn in similar habitat (Jackson et al. 1996).

Juvenile Pacific lamprey, termed ammocoetes, swim up from the nest and are washed downstream, where they burrow into mud or sand to feed by filtering organic matter and algae (Moyle 2002). The ammocoetes generally remain buried in the substrate for five or six years, moving from site to site (Wydoski and Whitney 1979). Such an extended freshwater residence makes ammocoetes especially vulnerable to degraded stream and water quality conditions, including bedload disturbances.

Pacific lamprey are present in the Sandy River Basin. However, there is little available information regarding population abundance and distribution for Pacific lamprey in the Sandy River and associated tributaries. In the Bull Run watershed, there have been sporadic observations of Pacific lamprey in the lower six miles of the river. In the past, adult lamprey have been observed migrating upstream in the Bull Run River from late April through the fall (October to November). PGE biologists have assumed these fish were Pacific lamprey (PGE 2002). In addition, adult Pacific lamprey have been observed in the Still Creek fish trap. It is a widespread perception that population numbers have been declining over the last several decades (USFS 1996).

River Lamprey (*Lampetra ayresi*)

River lamprey are federally listed as a species of concern. Little information is known about the reasons for their decline.

River lampreys spend most of their life in fresh water. In the spring following metamorphosis, development of their oral feeding discs is complete, and they enter the ocean to feed. River lamprey enter saltwater between May and July and promptly begin feeding. They remain close to shore and are found mostly near the mouths of their natal rivers. River lampreys remain in the ocean for only about 10 weeks. They leave salt water in September when they are about 10 inches (25 cm) long (Beamish and Youson 1987). They are assumed to spawn the following spring, although adults are rarely seen in fresh water. During the brief periods that river lamprey are distinctive in fresh water, they are not seen, probably because they are in deep water habitats in the mainstems of larger rivers (Beamish and Youson 1987). They may prefer larger rivers, including the Fraser, Columbia, and Sacramento (Kan 1975).

No specific information is available on life history, distribution, or abundance of river lamprey in the Sandy River Basin. However, based on potential suitable habitat conditions in the Bull Run and Sandy Rivers, it is possible that river lamprey are present in the Sandy River Basin. It is assumed that many of the factors affecting the freshwater habitat of river lamprey would be similar to the habitats of Pacific and western brook lamprey, which includes habitat, temperature, and flow conditions.

Western Brook Lamprey (*Lampetra richardsoni*)

Western brook lamprey are not state or federally listed as a sensitive species. Similar to Pacific lamprey, freshwater habitat degradation is likely the most significant threat to western brook lamprey populations. Habitat issues potentially affecting lamprey ammocoetes include streambed siltation, water pollution, hydrologic modifications, and development in or above rearing areas (Kostow 2002). Migrating adult lamprey have difficulty negotiating fish ladders, thus in-channel structures, dams, and perched culverts could inhibit access to spawning habitats. In addition, when lamprey are migrating downstream to the ocean, they are thought to be highly susceptible to injury and mortality at fish screens because of their small size.

Western brook lamprey, like Pacific lamprey and probably river lamprey, spawn in the spring. The eggs hatch according to the temperature of the water (Kostow 2002). After the larvae emerge, they quickly move to silty areas to burrow (Kostow 2002). Western brook lampreys distribute themselves within a creek system according to size, with small ammocoetes located farther upstream and in finer silt deposits in shallower waters than large ammocoetes inhabit (Kostow 2002). They are filter feeders with a diet consisting of mostly diatoms (Kostow 2002). After metamorphosis, the western brook lamprey apparently enter deep burrows and become dormant. They stay in these burrows until about March, when they are ready to spawn. Readiness to spawn is temperature dependent, and they will remain in the burrows until water temperatures reach above 50°F (10°C) (Kostow 2002). When they emerge as sexually mature fish, they range in size from approximately 3 to 7 inches. Western brook lamprey do not appear to move very much during their lives. Most of their movement is passive downstream displacement when they leave their burrows.

There is little available information regarding population abundance and distribution for western brook lamprey in the Sandy River and associated tributaries. However, based on potential suitable habitat conditions in the Bull Run and Sandy Rivers, it is possible that western brook lamprey are present in the Sandy River Basin.

Other Special-Status Fish Species in the Sandy River Basin

In addition to the species described above, one other special-status fish species – the Malheur mottled sculpin – has the potential to occur in the Sandy River Basin and is described below.

Malheur Mottled Sculpin *(Cottus bairdi* ssp.)

Malheur mottled sculpin are currently state-listed as a critical species and federally recognized as a species of concern. In the Columbia River Basin, the primary threat to this species is hydroelectric development.

Mottled sculpin are a small fish, with adults reaching only about 3 inches in length. This species prefers cool, flowing water streams, and it is associated with rubble, gravel, or rocky bottoms. This sculpin is seldom found in silted areas. Little is known about the distribution of this species. In Oregon, it is mostly found in small tributaries and disconnected streams in Malheur Basin, the Snake River, and the Columbia River (ODFW 2005b). There are no known occurrences of the Malheur mottled sculpin in the Sandy River Basin.

3.9 Socioeconomics and Environmental Justice

3.9.1 Regulatory Framework

This section was prepared in compliance with Presidential Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low income Populations* (EO 12898), dated February 11, 1994, and Title VI of the Civil Rights Act of 1964. Both EO 12898 and Title VI address persons belonging to the following target populations:

- Minority – all people of the following origins: Black, Asian, American Indian and Alaskan Native, Native Hawaiian or Other Pacific Islander, and Hispanic[1]
- Low income – persons whose household income is at or below the U.S. Department of Health and Human Services poverty guidelines.

Definitions of minority and low income areas were established on the basis of the Council on Environmental Quality (CEQ) document, *Environmental Justice Guidance Under the Environmental Policy Act* of December 10, 1997. CEQ's guidance states that "minority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the population percentage of the affected area is meaningfully greater than the minority population

[1] Hispanic is an ethnic and cultural identity and is not the same as race.

percentage in the general population or other appropriate unit of geographical analysis." The CEQ further adds that "The selection of the appropriate unit of geographical analysis may be a governing body's jurisdiction, a neighborhood, a census tract, or other similar unit that is chosen so as not to artificially dilute or inflate the affected minority population."

The CEQ guidelines do not specifically state the percentage considered meaningful in the case of low income populations. For this study, the assumptions set forth in the CEQ guidelines for identifying and evaluating impacts on minority populations are used to identify and evaluate impacts on low income populations. More specifically, potential environmental justice impacts are assumed to occur in an area if the percentage of minority, Hispanic, and low income populations are meaningfully greater than the percentage of minority, Hispanic, and low income populations in the general population.

In addition, U.S. Environmental Protection Agency guidance specifically addresses environmental justice effects on Indian tribes:

> Federal duties under the Environmental Justice E.O., the Presidential directive on government-to-government relations, and the trust responsibility to Indian tribes may merge when the action proposed by a Federal agency or EPA potentially affects the natural or physical environment of a tribe. The natural or physical environment of a tribe may include resources reserved by treaty or lands held in trust; sites of special cultural, religious, or archeological importance, such as sites protected under the National Historic Preservation Act or the Native American Graves Protection and Repatriation Act; other areas reserved for hunting, fishing, and gathering (usual and accustomed), which may include "ceded" lands that are not within reservation boundaries. Potential effects of concern…may include ecological, cultural, human health, economic, or social impacts when those impacts are interrelated to impacts on the natural or physical environment.

Through the EIS process, NMFS will ensure that the requirements of Executive Order 12898 regarding environmental justice are implemented, including all appropriate tribal consultation activities. During the public scoping phase of the project (Subsection 1.3.2), letters were sent to four members of the Confederated Tribes of the Warm Springs Reservation, seeking comments

3.9.2 Affected Environment

For this resource, the study area is different than the action area. For purposes of evaluating the potential socioeconomic and environmental justice impacts, two study areas are defined: 1) the three-county Portland Metropolitan area for the socioeconomic discussion (i.e., rate impacts), and 2) the Sandy River Basin for the environmental justice discussion. For socioeconomic conditions, the study area includes the three-county area encompassing the City's retail and wholesale water service areas

(Clackamas, Multnomah, and Washington Counties) because data for some of the socioeconomic variables (i.e., population and employment) are only available at the city or county level. Thus, information on population and employment is provided for both the three-county area as well as the City's service area. Figure 3.9-1 shows the City's retail and wholesale areas.

In accordance with the CEQ guidelines discussed in Subsection 3.9.1, Regulatory Framework, the study area for environmental justice is limited to the five census tracts within the Sandy River Basin. This encompasses the action area. Three of the census tracts are in Clackamas County and two are in Multnomah County. Figure 3.9-2 shows the five census tracts.

3.9.2.1 Population

The population of the City's service area was estimated to be approximately 809,000 people in 2006 (City of Portland, 2007b). This number is expected to increase to approximately 818,000 during the current (2007) year, about a 1 percent increase from the 2006 population estimate (City of Portland, 2007b). Between 1990 and 2000, the service area's population grew by approximately 12 percent, with an annual average compounded growth rate of 0.22 percent (Metro, 2002). Table 3.9-1 shows the current and historical population in the service area, the larger three-county area, and the state as a whole. These estimates represent the population represented by both retail and wholesale customers during the periods shown. As of July 1, 2006, the population for the three-county area encompassing the City's service area was estimated at 1,569,953 people (City of Portland, 2007b). The population in this area has been increasing at almost the same rate as that for the state of Oregon as a whole. Between 1990 and 2000, the area's population grew by 23 percent while the state's population increased by 20.4 percent (Metro, 2002). Among the counties considered, Washington County had the largest population increase (42.9 percent), while Multnomah had the smallest increase (13.1 percent) (Metro, 2002). Population has continued to increase since the 2000 U.S. Census, with Washington County continuing to show the largest increase (15.5 percent), while the area population has grown by about 9 percent (City of Portland, 2007b).

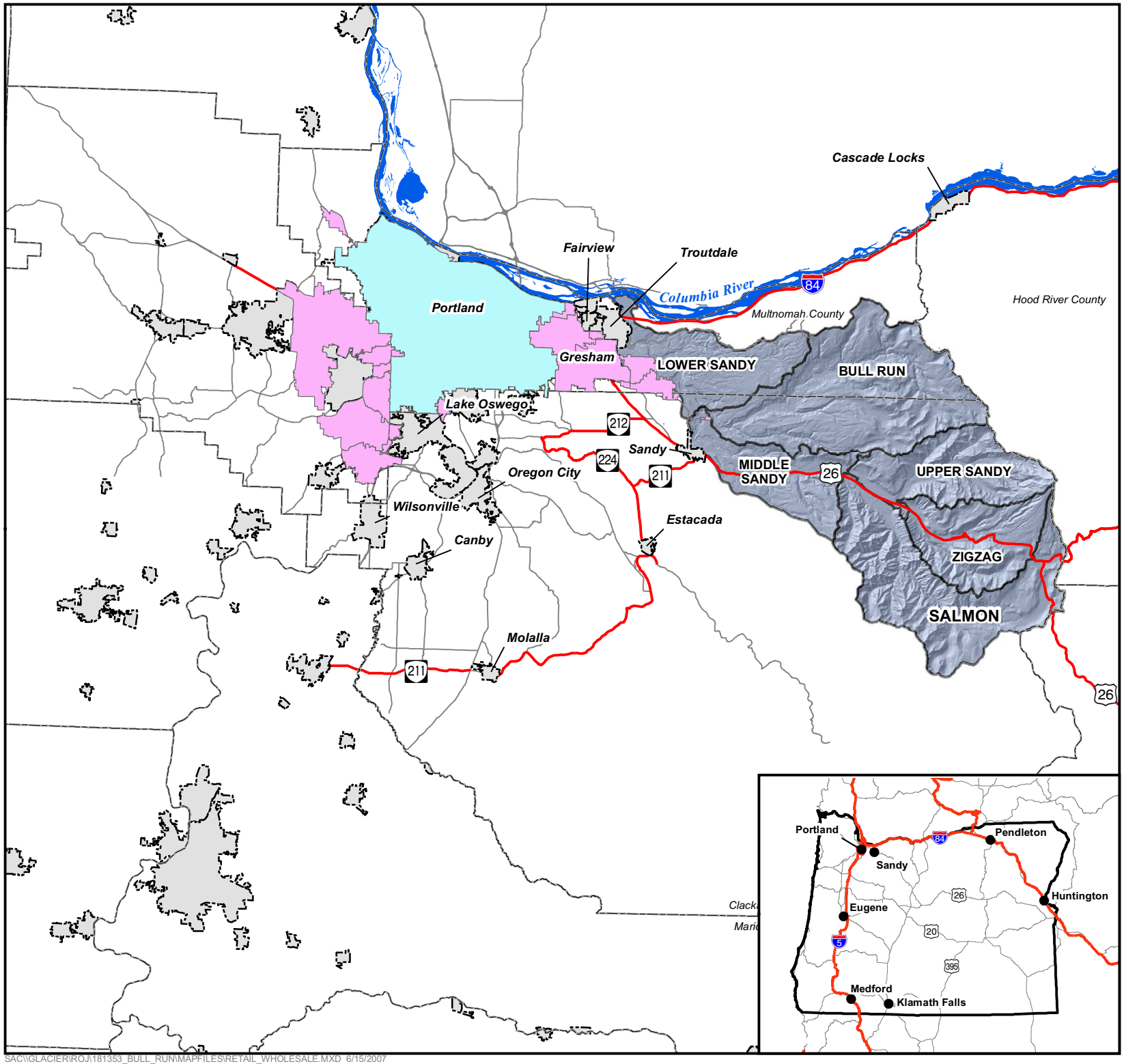
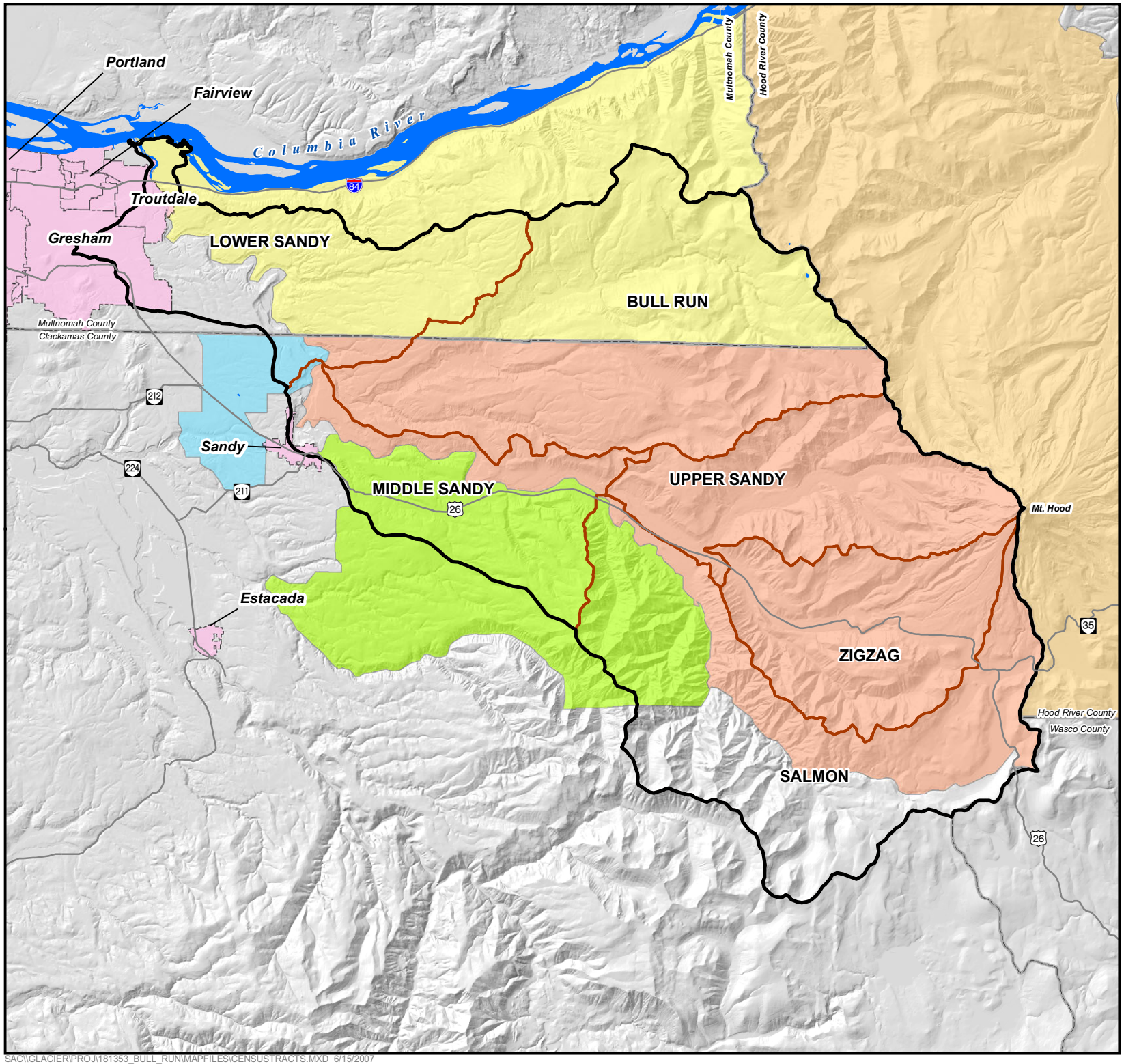


Figure 3.9-1
Retail and Wholesale Service Areas
Bull Run HCP EIS

SAC\\GLACIER\ROJ\181353_BULL_RUN\MAPFILES\RETAIL_WHOLESALE.MXD 6/15/2007



Key Boundaries

- Sandy River Basin
- Sandy River Basin Watersheds

Census Tracts

- 105
- 234.01
- 243.01
- 243.02
- 95.01

Projection:
State Plane Oregon North Feet
North American Datum 1983

N

0 2.5 5 Miles

0 4,023 8,046 Meters

Scale =1:316,800

Sources: The Oregon Geospatial Enterprise Office, 2007; CH2M HILL, 2007.

Figure 3.9-2
Map of Census Tracts
Bull Run HCP EIS

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Table 3.9-1 Recent population estimates

Area	1990	2000	2006	Percent Change 1990-2000 (%)	Percent Change 2000-2006 (%)
City Service Area	714,575	798,598	809,002	11.8	1.3
Clackamas County	278,850	338,391	374,230	21.4	10.6
Multnomah County	583,887	660,486	681,454	13.1	3.2
Washington County	311,554	445,342	514,269	42.9	15.5
Three-County Area	1,174,291	1,444,219	1,569,953	23.0	8.7
State of Oregon	2,842,321	3,421,399	3,700,758	20.4	8.2

Sources: City of Portland 2007b; U.S. Census 1990, 2000; U.S. Census Bureau 2007

Table 3.9-2 summarizes retail and wholesale population forecasts for the City's service area. As the numbers in the table indicate, the population in City's service area is expected to increase by about 22 percent between the current year (2007) and 2030. Table 3.9-2 also shows the State of Oregon's Office of Economic Analysis population forecast for the larger three-county area, and the state as a whole. The Office of Economic Analysis bases its forecast estimates on U.S. Census data and periodically updates them. The estimates in Table 3.9-2 are derived from the 2004 Census updates.

Table 3.9-2 Population forecasts

Area	2010	2020	2030	2040
City Service Area	843,725	924,920	995,728	Not Available
Clackamas County	391,536	460,323	536,123	620,703
Multnomah County	711,909	756,390	800,565	842,009
Washington County	542,678	660,367	788,162	920,852
Three-County Area	1,646,124	1,877,080	2,124,849	2,383,564
State of Oregon	3,843,900	4,359,258	4,891,225	5,425,408

Source: City of Portland 2007b; Oregon Office of Economic Analysis 2007

3.9.2.2 Employment

According to the U.S. Bureau of Economic Analysis (2007), the employment base in 2004 for the three-county area consisted primarily of services, government, manufacturing, and retail trade, as summarized in Table 3.9-3.

Table 3.9-3 Employment by industry, 2004

Sector	Clackamas	Multnomah	Washington	Total
Agriculture	1,640	(D)[1]	1,389	N/A
Mining	242	(D)	349	N/A
Utilities	300	1,706	(D)	N/A
Construction	14,780	24,663	15,966	55,409
Manufacturing	19,783	37,868	46,462	104,113
Wholesale Trade	12,006	25,792	18,405	56,203
Retail Trade	23,407	48,616	31,403	103,426
Transportation and Warehousing	6,714	22,455	(D)	N/A
Information	2,375	13,232	7,295	22,902
F.I.R.E.[2]	21,009	50,816	19,890	91,715
Services	78,445	242,407	99,063	419,915
Government	17,284	69,758	19,037	106,079
Total	205,493	539,628	269,033	1,014,154

Source: Bureau of Economic Analysis 2007

[1](D) = Not shown to avoid disclosing confidential information; estimates for this item are included in the totals.
[2]F.I.R.E. = Finance, insurance, real estate, rental and leasing

The 2006 annual average unemployment rate in the three-county area was less than that for the state as a whole, as indicated in Table 3.9-4. On average, there was a total of 41,124 unemployed persons in the area. The majority (19,256) of the unemployed were in Multnomah County.

Table 3.9-4 2006 employment data

Area	Labor Force	Employment	Unemployed	Unemployment Rate (%)
Clackamas County	196,681	187,217	9,464	4.8
Multnomah County	371,888	352,632	19,256	5.2
Washington County	277,520	265,116	12,404	4.5
Three-County Area	846,089	804,965	41,124	4.9
State of Oregon	1,899,000	1,796,000	103,000	5.4

Source: Bureau of Labor Statistics 2007

3.9.2.3 Water Rates

Water Rates

The water rates charged by the City are set each fiscal year by the Portland City Council. The City has both retail and wholesale rates (City of Portland, 2007b). These rates differ for residential and commercial customers (City of Portland, 2007b). The City's water bill includes a base charge that covers a portion of the cost of reading and inspecting meters, servicing customer accounts, and billing (City of Portland, 2007b). The base charge may include charges for both water and sewer services (City of Portland, 2007b). The City also charges customers on the basis of volume usage (City of Portland, 2007b). For the current fiscal year (July 1, 2007, through June 30, 2008), the City charges its customers at the single rate of $1.77 per "unit" (100 cubic ft. of water [ccf]) (City of Portland, 2007b). Until recently, the City had a multi-tier block rate structure for water volume. However, the City Council temporarily suspended the multi-tier block rate structure for water volume because of technical difficulties with its billing software (City of Portland, 2007b).

The average monthly bill (based on average use) for the typical customer (residential and commercial) is shown in Table 3.9-5 for Fiscal Year 2007-08. The volume usage shown is the average or typical water use by each of the customer classes shown (City of Portland, 2007c).

Table 3.9-5 Monthly equivalent of a typical water bill including base charge rates

	Monthly Bill Data[1]	
Customer Class	**Volume per month (units of 100 cubic feet of water)**	**Fiscal Year 2007–2008 ($)**
Single-Family Residential		
Base charge		6.55
Volume charge	7	13.02
Total		**19.57**
Low income Residential		
Single-Family Residential (above)		19.57
Discount	5	6.35
Total		**13.22**
Mid-size Commercial		
Base charge		19.66
Volume charge	200	372.00
Total		**391.66**

Source: City of Portland 2007b, 2007c

[1]Assumes water volume charge of $1.86 per ccf (unit of 100 cubic ft. of water). One ccf is equivalent to 748 gallons.

The City has programs that assist households that cannot afford their services. One of these programs offers any eligible household experiencing financial crisis a voucher for up to $150 in assistance once every 12 months (City of Portland, 2007b). Households have to be enrolled in the City's low income assistance program to qualify for such assistance (City of Portland, 2007b). The City of Portland also offers financial assistance for repair of leaky toilets, faucets, plumbing and underground leaks. This assistance is available to customers eligible for financial assistance who own and occupy their own homes (City of Portland, 2007b).

3.9.2.4 Environmental Justice

Table 3.9-6 outlines the racial minority and Hispanic population distributions for the five census tracts within the Sandy River Basin. Table 3.9-7 does the same for the low income population. The minority and income data are from the 2000 U.S. Census. Of the overall total population within the identified census tracts, approximately 10.3 percent are minority, 4.8 percent are of Hispanic origin,[2] and 9.2 percent are low income. The distribution of minority, Hispanic, and low income populations for both Clackamas and Multnomah Counties, and for the state, are also shown in the two tables. These values were used to determine if the presence of these populations in the City's service area are meaningfully greater than those in the general populations. Using the CEQ guidelines, the percentage of minority, Hispanic, and low income populations in the City's service area is not meaningfully greater than the proportion of these populations in the counties or in the State.

Table 3.9-6 Monthly equivalent of a typical water bill including base charge rates

Area	Population	Non-Hispanic White	Minority	Percent Minority	Hispanic Origin	Percent Hispanic Origin
Census Tract 95.01[1]	4,104	2,884	1,220	29.7	210	5.1
Census Tract 105[1]	3,751	3,615	136	3.6	127	3.4
Census Tract 234.01[2]	4,375	3,969	406	9.3	238	5.4
Census Tract 243.01[2]	5,570	5,158	412	7.4	311	5.6

[2] Hispanics or Latinos are those people who classified themselves in one of the specific Spanish, Hispanic, or Latino categories listed on the Census 2000 questionnaire – "Mexican, Mexican Am., Chicano," "Puerto Rican," or "Cuban" – as well as those who indicated that they are "other Spanish/Hispanic/Latino." People who identify their origin as "other Spanish/Hispanic/Latino" may be of any race. Thus, the percent Hispanic should not be added to percentages for racial (i.e., minority) categories.

Table 3.9-6 Monthly equivalent of a typical water bill including base charge rates

Area	Population	Non-Hispanic White	Minority	Percent Minority	Hispanic Origin	Percent Hispanic Origin
Census Tract 243.02[2]	4,880	4,727	153	3.1	192	3.9
Total (Census Tracts)	**22,680**	**20,353**	**2,327**	**10.3**	**1,078**	**4.8**
Clackamas County	338,391	308,512	29,879	8.8	17,021	5.0
Multnomah County	660,486	521,482	139,004	21.0	49,474	7.5
State of Oregon	3,421,399	2,957,510	463,889	13.6	273,938	8.0

Source: 2000 Census

[1]Census tracts in Multnomah County
[2]Census tracts in Clackamas County

Table 3.9-7 Distribution of low income population

Tract	Total Population[1]	Income below Poverty Level	Percent low income
Census Tract 95.01[2]	4,104	412	10.0
Census Tract 105[2]	3,743	317	8.5
Census Tract 234.01[3]	4,355	273	6.3
Census Tract 243.01[3]	5,556	330	5.9
Census Tract 243.02[3]	4,880	751	15.4
Total (Census Tracts)	22,638	2,083	9.2
Clackamas County	335,122	21,969	6.6
Multnomah County	645,584	81,711	12.7
State of Oregon	3,347,667	388,740	11.6

Source: 2000 Census

[1]Population numbers are only those for whom poverty was determined and exclude full-time college students.
[2]Census tract in Multnomah County.
[3]Census tract in Clackamas County.

3.10 Cultural Resources

3.10.1 Regulatory Framework

The National Historic Preservation Act (NHPA) of 1966, Section 106, and its implementing regulations (35 CFR part 800, as amended in 1999) require Federal agencies and entities they fund or permit to consider the effects of their actions on properties that may be eligible for listing or are listed in the National Register of Historic Places (NRHP). To determine whether an undertaking could affect NRHP-eligible properties, cultural resources must be inventoried and evaluated. The NRHP criteria are used to evaluate resources when complying with NHPA Section 106. Those criteria state that eligible resources comprise:

> …[D]istricts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that (a) are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction; or (d) that have yielded or may be likely to yield, information important to history or prehistory.

Section 106 of the NHPA contains additional criteria considerations for National Register eligibility and generally excludes properties that are less than 50 years old. According to Section 106, an undertaking has an effect on an historic property when the undertaking may alter the characteristics of the property that may qualify the property for inclusion in the National Register (36 CFR, Part 800.9[a]). An effect is considered adverse when the effect on an NRHP-eligible property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include the physical destruction of all or part of the property (36 CFR, Part 800.9[b]).

Archaeological sites and, in particular, Native American human burials are protected under Oregon state laws as well, on both public and private land. Preservation and protection of "the cultural heritage" of Oregon "embodied in objects and sites that are of archaeological significance" (defined as NRHP-listed or -eligible sites) is the declared intent of statutes ORS 358.905 to 358.955. No person may "excavate, injure, destroy, or alter an archaeological site or object or remove an archaeological object located on public or private lands in Oregon" unless the activity is authorized by a permit issued by the SHPO. Indian graves, funerary objects, and other sacred objects are protected under ORS 97.740-97.760. Disturbance of graves is specifically prohibited, even through accidental discovery and

even if reviewing agencies have concurred that a particular project is in compliance with applicable state and Federal regulations.

3.10.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and/or potentially affected by covered activities.

The following subsections present the regional cultural setting, prehistoric background, ethnographic history, and historic background of the action area. In addition, Subsection 3.10.2.5, Summary of Previous Cultural Resources Research in the Sandy River Basin, provides a context for potential cultural resources located in the action area.

3.10.2.1 Regional Cultural Setting

Prior to Euro-American contact and colonization, the Lower Columbia River Valley, including the Portland and Mt. Hood region, was populated by numerous groups speaking closely related languages and dialects of the Chinookan language family (French and French 1998; Hajda 1984; Minor 1983; Silverstein 1990). Chinookan peoples lived along the Columbia River and the lower reaches of its principal tributaries from the Pacific Coast inland to The Dalles. Their descendants continue to reside in this region.

3.10.2.2 Prehistoric Background

The prehistoric context of the Portland area has been explored and interpreted through a variety of investigations (Ames 1994; Minor 1986, 1998; Minor et al. 1993, 1994; Pettigrew 1981, 1990). Similar research in the Western Cascades foothills and mountains has been incorporated into overviews of upland prehistory and models for prehistoric and historical land use (Bryant et al. 1978; Burtchard 1990; Burtchard and Keeler 1991; Burtchard et al. 1993; Minor et al. 1980; Oetting 2004a). Because few detailed archaeological investigations have been conducted in the Sandy River Basin, these studies have been used to develop archaeological overview described below.

Paleo-Indian (ca. 13,000–8,500 Before Present [BP])

This period covers the largely undocumented initial human colonization of this portion of North America (Ames and Maschner 1999; Minor 1998; Minor et al. 1980). During this period, the Pleistocene Ice Age glaciers retreated, resulting in numerous environmental changes. In the Pacific Northwest and elsewhere in North America, population density was probably quite low and human groups were small and highly mobile.

Fluted and other large lanceolate points, characteristic of this period, have been found at scattered locations in the Pacific Northwest (Burnett 1995; Minor 1985). The only artifact that may date to this period in the northern Oregon Cascades is a lanceolate biface fragment, located on a ridge above the Collawash River in the upper Clackamas River drainage (Burtchard 1990).

Early Archaic (ca. 8,500–5,000 BP)

The economic strategies defining this period, as well as the following two periods, have been traditionally identified as the Archaic Stage (Willey and Phillips 1958). The Archaic Stage is characterized by hunting and gathering cultures that made selective use of tools, and it is often subdivided into early, middle, and late periods (Minor 1998).

The Early Archaic was a period of coping with and adapting to the developing environment of the Holocene, which was becoming warmer and drier. In the Pacific Northwest, the warming environmental conditions shifted biotic communities to higher elevational settings. Initial occupations at numerous archaeological sites in the Cascades appear to date to this period. The probable Early Archaic age of many sites is based on the presence of leaf-shaped projectile points, generally referred to as Cascade points. A single leaf-shaped Cascade point has been found in the Sandy River Basin, within the Bull Run River Watershed (Ellis et al. 2006). This isolated artifact was found near Bull Run Dam 1, within the remnants of the construction camp used in the 1920s.

Middle Archaic (ca. 5,000–2,500 BP)

The regional climate began to improve in the early part of this period and developed into the modern climatic regime by the end of this period. Biotic communities continued adjusting, with forests expanding and displacing grasslands in the western Cascades. The mobile foraging patterns of earlier times likely changed as human population density rose (Burtchard 1990, Burtchard et al. 1993). People intensified their use of and reliance on certain foods that could be harvested in large quantities and stored for extended periods. While groups of people still moved about the landscape to acquire specific resources, these were more often small task-specific parties, rather than movement of the entire group.

Three Middle Archaic age sites have been identified in the Sandy River Basin, including a lithic scatter buried by volcanic lahar sediments on a terrace above the Sandy River at the former Marmot Dam (Oetting 2003, 2004b). In addition, a broad-necked projectile point base and a lanceolate point with a square base, both considered to be Middle Archaic in age, were recovered at two sites on the Bull Run River near and at the upper end of Bull Run Reservoir 1 (Ellis et al. 2006).

Late Archaic/Formative (ca. 2500–500 BP)

In general, cultural developments during this time are seen as refinements of the cultural patterns that had emerged in the preceding period (Ames and Maschner 1999; Burtchard 1990; Pettigrew 1990). Populations continued to grow, settlement patterns became more sedentary, reliance on specific dependable and storable foods increased, and increasingly complex social organizations emerged.

Occupation at most Middle Archaic period sites in the Portland Basin lowlands and in the neighboring river canyons and uplands continued into the Late Archaic period (Pettigrew 1981, 1990; Minor et al. 1994). The situation is less clear in the Sandy River Basin. One site in the Sandy River Basin contained narrow-necked projectile points with a radiocarbon age of 1,340 BP (Woodward 1974), but no narrow-necked points have been found at any other recorded sites in the basin. The lack of such points at sites recently tested in the Bull Run River Watershed was specifically noted by Ellis et al. (2006: pages 66 to 67). Ellis et al. (2006) suggested that changes in settlement patterns during this period, with populations becoming more concentrated along major rivers, caused changes in resource procurement, resulting in more limited use of upland resources. Volcanic activity on Mt. Hood may also have played a role in limiting Late Archaic use of the Sandy River Basin (Oetting 2003, 2004b).

Euro-American Contact (ca. 500 BP-Present)

The catastrophic population losses suffered by indigenous groups caused by epidemic European diseases undoubtedly had profound effects on their culture and economy. While diseases devastated Columbia River populations just before and after direct contact with Euro-Americans in the late eighteenth century (Boyd 1985), infectious diseases may have spread well in advance of direct contact, with equally harmful results (Campbell 1990; Dobyns 1983). Due to changing population demographics and the disruption of traditional social interactions, however, the groups most likely altered their settlement and subsistence practices. Many villages and task sites were abandoned. The labor-intensive food procurement and processing economies of the preceding period might not have been viable with the reduced group sizes, leading to changes in seasonal movement patterns or a return to seasonal movements for formerly sedentary groups.

The effect of these changes in the Cascades uplands was probably a substantial reduction in use of the region, thus resulting in a corresponding reduction in archaeological sites with evidence of late prehistoric activity. Many sites with evidence of intensive regular use prior to this period appear to have been abandoned.

3.10.2.3 Ethnographic Context

A variety of people may have visited and used the Sandy River region, but the area was probably primarily used by the Cascades Chinookans and the Molala (Hajda and Ellis 2001). Modern ethnographic summaries indicate that the Molala inhabited the western Cascades uplands south of Mt. Hood (Zenk and Rigsby 1998), but there is little information about their residential locations or settlement patterns.

Chinookans

The Chinookan language family is an independent branch of the Penutian phylum of languages (Silverstein 1990). Lower Chinookan was spoken by groups near the mouth of the Columbia River, while groups upstream spoke three closely related Upper Chinookan languages: Cathlamet, Multnomah, and Kiksht.

Chinookans were particularly susceptible to the devastating epidemic diseases that accompanied Euro-Americans to the Western Hemisphere because of the high population densities in the Columbia River region (Boyd 1985). However, the lives of various Chinookan groups were fairly similar, so a general view of pre-contact Chinookan culture can be reconstructed to some degree by emphasizing recurrent patterns found among the various groups and amalgamating details from individual groups (Beckham 1998; Silverstein 1990).

Lewis and Clark journals provide information on human use of the Sandy River region in the early 1800s. While returning up the Columbia River in April 1806, the expedition camped opposite the mouth of the Sandy River. Lewis and Clark had assumed that this river was the primary drainage of the valley south of the Columbia River, but local Indians informed them that the headwaters of this river were on the western slopes of Mt. Hood and that no one regularly lived along this river. This information indicates that no Indian group lived along the Sandy River, but people from many local Chinookan groups must have visited and made use of the region, because everyone queried knew the terrain of the Sandy River region.

While people may not have permanently resided in the Sandy River Basin, the region was undoubtedly used (French et al. 1995, 2000; Winthrop 1991). Trails provided access to and through the region. East-west trails converged on Barlow Pass south of Mt. Hood, which provided an excellent route across the crest of the Cascades. North-south trails across Lolo Pass connected the southern slopes of Mt. Hood to the Hood River Watershed and the Columbia River. Chinookans and other ethnic groups traveled to the south and west slopes of Mt. Hood to harvest a variety of plant and animal resources,

especially huckleberries (Winthrop 1991). Other plants collected included bear grass, hazelnuts, pine nuts, a variety of berries, and a variety of plants used for medicinal purposes (Wilson 1993; Winthrop 1991). Bark was peeled from western redcedar trees to make baskets and other products.

Molala

There are few references to the Molala in historical accounts. Ethnographic research with Molala people occurred primarily on reservations in the early twentieth century (Zenk and Rigsby 1998). Thus, information on language and life is limited. As with Chinookan, Molala is within the Penutian phylum of languages, but it is considered a language isolate that is not closely related to any other Penutian language (Rigsby 1965).

The Molala lived in and used the uplands of the Western Cascade and High Cascade mountains, although few data are available on specific settlement locations and the uses of particular areas. Three geographic and linguistic subgroups have been recognized: the Northern Molala, who frequented the Molalla River and Mt. Hood regions; the Southern Molala, found in the mountains west of Klamath Lake and in the Cascade uplands of the Umpqua and Rogue River basins; and the Upper Santiam, a little-known group that occupied the vicinity of the Santiam River and used the surrounding uplands of eastern Linn and Lane counties (Toepel 1987; Zenk and Rigsby 1998).

The Molala followed an annual cycle of movement to obtain resources as they became available in different areas. Molala families probably ascended and descended in elevation in the uplands as the seasons changed and different resources became available at differing locations and altitudes. Hunting was a mainstay of the economy and probably included a wide variety of animals, although deer and elk were the most important species (Zenk and Rigsby 1998). Gathering roots, nuts, and berries was also an important seasonal activity that may have brought larger groups together for extended stays in favored harvesting locations (Spier and Sapir 1930: page 160).

Little information is available regarding social organization (Zenk and Rigsby 1998). Leadership was primarily task oriented, but wealthy individuals usually had considerable local influence. Like the Chinookans, wealth probably also influenced social distinctions. Relations between the Molala and Upper Chinookans were close and cordial, with intermarriages and exchanges of foods and valuables (Zenk and Rigsby 1998).

3.10.2.4 Historical Background

Direct contact between Columbia River Chinookans and Euro-Americans began in 1792 when Robert Gray located the mouth of the river and parties under the command of George Vancouver sailed up the

river into the Portland Basin. Interactions were intermittent and limited to coastal fur trading ships until the arrival of the Lewis and Clark expedition. The Lewis and Clark party descended the Columbia River in the fall of 1805 and retraced their route upriver in 1806. The expedition gathered information on geography, demography, and natural resources from the local Indians, and recorded the first detailed descriptions of the Chinookan people. They mapped and named the Sandy River.

Euro-American fur trappers, traders, and adventurers soon began entering and exploring the region. Astoria, near the mouth of the Columbia River, was founded in 1811 by American fur entrepreneur John Jacob Astor. The British North West Company sent overland trapping expeditions into the region from Canada. North West Company trading posts were established in the Portland Basin and northern Willamette Valley in 1812 and 1813, and the company acquired the permanent settlement at Astoria (renamed Fort George). The Hudson's Bay Company (successor to the North West Company) constructed Fort Vancouver on the north bank of the Columbia River in 1825, and this post quickly became the focus of Euro-American activities in the region. By the 1830s, an increasing number of trappers, missionaries, and other travelers were visiting and sometimes settling in Oregon, primarily in the Portland Basin and the northern Willamette Valley (Minor et al. 1980). Diseases had devastated the Native Americans of the region to such an extent that few remained as the influx of Euro-Americans increased.

The moderate climate and rich soil of the Willamette Valley were well publicized in the United States, and emigrants began arriving via the Oregon Trail in the 1840s and 1850s. By the late 1850s, treaties between the U.S. government and surviving Indian groups had resulted in the removal of most Oregon Indians to reservations. Most of the remaining Cascades, Clackamas, and Molala people were moved to the Grand Ronde Reservation on the west side of the Willamette Valley (Hajda and Ellis 2001). Some moved to other reservations, including Siletz and Warm Springs. However, individuals and families were permitted to leave the reservation for fishing and to obtain other resources, so some traditional places continued to be used. In addition, some families did not move, blending to lesser or greater extent into the growing Euro-American population.

Many emigrants passed through the Sandy River valley on the Barlow Road or crossed the mouth of the river after braving the hazards of the Columbia River Gorge. After arriving in Oregon City, the end of the Oregon Trail, most people continued on to the Willamette Valley, but some settled in the Sandy River Basin, primarily near the mouth of the river, in and near present-day Troutdale (General Land Office 1861, 1862, 1898). Due to its remote setting and rugged terrain, the Sandy River Basin saw little development through much of the second half of the nineteenth century. The subsequent history of the

region, however, is linked to this remoteness, the general lack of settlement, and the quality and quantity of its rivers. These factors contributed to the use of the Bull Run Watershed by the City of Portland for its water supply and the formation and development of the Mt. Hood National Forest.

Bull Run Water Supply System

At its founding in the mid-1850s, Portland initially relied upon private wells and, later, privately operated water supply systems that drew water from the Willamette River, Caruthers Creek, and other smaller streams in the local vicinity. As Portland grew, its water and sanitation systems became increasingly stressed by a growing population and inadequate practices (Harmon 1995). By the 1870s, the major local provider of domestic supply, the Portland Water Company, was increasingly unable to meet the City's needs and water quality became a significant local political issue (Lansing 2005; MacColl 1988). An appointed Water Committee was charged with preliminary investigation regarding the design and funding of a municipal water supply system. Interest soon focused on the Bull Run River area.

Bull Run's potential as an urban water supply was first suggested by Charles Talbot and A. G. Cunningham, who secured water rights in the area in 1883 (Harmon 1995). The Water Committee purchased the rights to Bull Run from Talbot and Cunningham along with other riparian rights to protect the quality of the water supply. In 1892, President Benjamin Harrison designated the Bull Run area a national forest reserve, prohibiting future settlement or land purchase in the tract and assuring its water quality. A year later, in 1893, the Oregon Legislature provided authority for the City to issue bonds in the amount of $2.5 million, allowing major construction at Bull Run to begin.

Bull Run water flowed into Portland for the first time on January 2, 1895, after years of planning and construction (Harmon 1995; Kaiser 1922). Management of the Bull Run Forest Reserve was transferred to USFS in 1905. The City of Portland completed construction of Bull Run Dam 1, creating Reservoir 1 (also known as Lake Ben Morrow), in 1929 and Bull Run Dam 2 in 1962. Today the Bull Run Management Unit exists as a specially designated area within the Mt. Hood National Forest, jointly managed by USFS and the City.

Mt. Hood National Forest

The Cascade Range Forest Reserve was created in 1893, bringing public lands in the forested uplands of the Western Cascade Range under the administration of the Department of the Interior General Land Office (Bryant et al. 1978; Ellis 1978). The Forest Reserve system was an initial attempt to provide a variety of services and oversight for these public lands, dealing primarily with fire control, trail

improvement, trespassing, grazing, and timber thefts. The Cascade Range Forest Reserve was eventually renamed as the Mt. Hood National Forest (Bryant et al. 1978).

USFS took an active role in regulating and managing forest resources. Ranger stations and fire lookouts were established or renovated, and trails with adjacent telephone lines soon connected these facilities. Mt. Hood National Forest also established and maintained an increasing number of recreational facilities to serve the increasing public use of the forests. In particular, the Barlow Road corridor up the Sandy and Zigzag rivers to Mt. Hood became a favorite recreational destination for residents of the growing Portland metropolitan area. The Mt. Hood Loop Highway was opened in 1925 (Bryant et al. 1978). The Great Depression of the 1930s resulted in increased USFS development of the area through the work of the Civilian Conservation Corps. The corps provided labor for the construction of trails, roads, fire lookouts, and public campgrounds; extensive remodeling at the 1907 Zigzag Ranger Station; and the construction of Timberline Lodge on Mt. Hood.

3.10.2.5 Summary of Previous Cultural Resources Research in the Sandy River Basin

The prehistoric and historical site record and project files maintained by the Oregon State Historic Preservation Officer were consulted to identify previous cultural resources surveys and other investigations that have been conducted in the Sandy River Basin and to locate previously recorded archaeological sites in this watershed. The SHPO files contain current information from Mt. Hood National Forest and the Salem District of the Bureau of Land Management. In addition, City of Portland and USFWS records, as well as other relevant background literature were reviewed.

Previous Cultural Resources Investigations

At least 185 cultural resources projects, on file at SHPO, have been conducted in action area. Land ownership has been the primary determinant of previous cultural resources research. Most investigations have been conducted in conjunction with projects requiring compliance with Federal and/or state-mandated cultural resources requirements; thus, most investigations have been conducted on public lands or as part of projects using Federal funds or requiring Federal permits. The majority of these projects have been timber harvesting and other resource or recreation projects on lands administered by Mt. Hood National Forest or BLM; highway and other transportation-related projects generally under the oversight of the Oregon Department of Transportation; and hydroelectric utility projects, such as those managed by PGE and the City. As a result, the majority of previous investigations have been conducted on the forested canyon slopes and uplands upstream of the confluence of the Sandy and Bull Run Rivers or along road corridors. Transportation-related projects have been principally concentrated along the route of U.S. Highway 26, which parallels the Sandy and

Zigzag Rivers between the communities of Sandy and Government Camp. Fewer than 10 projects have been conducted near the mouth of the Sandy River or in the watershed below its confluence with the Bull Run River. Very few projects have been conducted immediately adjacent to the rivers and streams of the basin.

Documented Cultural Resources Sites

Thirty-one archaeological sites have been formally recorded in the Sandy River Basin. The 31 archaeological sites on file at the SHPO office include 12 prehistoric lithic or lithic and ground stone artifact scatter sites (which probably reflect short to long term Native American camp locations), 10 culturally modified tree ("peeled" tree) sites,[3] three rock features considered to be prehistoric in age (two rock cairns and a talus pit or seat), one possible prehistoric burial location, one pioneer-era grave site, and four other historical period sites. These historical sites include a tollgate location associated with the Barlow Road, a rock corral reputedly used by emigrants, and two refuse scatters.

One of the SHPO-recorded prehistoric lithic scatter sites has been determined eligible for NRHP listing, and at least three other lithic scatter sites have been evaluated as not eligible. Subsurface evaluation test excavations were conducted at these four sites (Minor and Oetting 1996; Oetting 2003).

Three other NRHP-listed historical sites are located in the Sandy River Basin. The historic Barlow Road segment of the Oregon Trail passes through the southern portion of the basin. By definition, this road is part of the Oregon Trail National Historic Trail (National Park Service 2006) and a defined segment near Government Camp is listed in the NRHP. Timberline Lodge, the well-known mountain resort built by the Civilian Conservation Corps in the 1930s, is listed in the NRHP. It is located on the southwest slope of Mt. Hood above the headwaters of the Zigzag and Salmon Rivers. The Mt. Hood National Forest Zigzag Ranger Station compound, on the outskirts of the community of Zigzag, was largely built by the conservation corps in the 1930s, and it is listed in the NRHP (Fulton and Marvin 1986).

Bull Run Water Supply System

Based on documentary sources for the Bull Run water supply system (City of Portland 2007d) and known history of the region (Harmon 1995), most permanent elements of the system survive and are

[3] "Culturally modified" or "peeled" tree sites are locations where people have purposefully peeled or stripped sections of bark and the underlying cambium layer from living trees for use in making baskets, bags, and other items. The resulting scars are considered cultural features that mark archaeological sites, even if no other human-produced artifacts are present (Rudisill and Seidel 2001).

near or more than 50 years old. They would therefore be subject to consideration as historical resources. Some elements of the original late nineteenth century development of the system (storage reservoirs located at Mt. Tabor Park and Washington Park, which are outside of the action area) have already been documented and are listed in the NRHP (National Register Nomination 2004a, 2004b).

System facilities in the action area and their period of construction include the following (Ellis et al. 2006; Harmon 1995; Kaiser 1922; City of Portland 2007d):

- 1893–1895: Headworks on the Bull Run River; Conduit No. 1; roads and bridges in connection with construction and conduit support
- 1917: Small dam built at Bull Run Lake
- 1925: Conduit No. 3
- 1926–1929: Bull Run Dam 1, creating Reservoir 1, also known as Lake Ben Morrow; project included worker camps (Bear Creek and City Camp with such structures as cottages, garages, cook houses, bunkhouses, and manager's offices); some of these structures survived and remained in use after construction (Ellis et al. 2006)
- 1930: L. S. Kaiser Park, including some housing units for workers
- 1953: Conduit No. 4
- 1958–1962: Bull Run Dam 2

Mt. Hood National Forest Sites

A number of Euro-American historical archaeological features and sites also have been described in a variety of Mt. Hood National Forest project reports, but when these reports were submitted to Oregon SHPO in the 1980s and 1990s, such historical sites were not being formally recognized by that office or assigned permanent site numbers. Under current SHPO standards, most of these locations would be recognized as archaeological sites, would be assigned permanent numbers, and would be subject to evaluation under Section 106. These locations included various sites and features, such as the early to mid-twentieth century USFS ranger or guard stations, other cabins and outbuildings, fire lookouts, fence lines, phone line routes (marked by old insulators), logging camps and other logging-related features (e.g., logging railroad grades and trestles, springboard-cut tree stumps, tools), early trail routes (often marked by blazed trees, remnants of footbridges), and historical refuse dumps and scatters.

3.11 Air Quality

3.11.1 Regulatory Framework

Air quality is regulated by the Federal Clean Air Act, which requires the EPA to set national ambient air quality standards (NAAQS) for pollutants considered harmful to public health and the environment. Pollutants for which standards have been established are termed "criteria" pollutants because the standards are based on criteria that show a relationship between pollutant concentrations and impacts on health and welfare. NAAQS have been set for five criteria pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM). Table 3.11-1 outlines the characteristics and health effects of each pollutant. A summary of the current NAAQS can be found at the EPA website: www.epa.gov/air/criteria.html.

If ambient concentrations of any of the criteria pollutants in an area exceed standards established for those pollutants, the area is designated a "nonattainment" area. For some pollutants, an area can be designated a basic, moderate, serious, severe, or extreme nonattainment area, depending on the level of pollutant concentrations. Likewise, if standards for pollutants are met in a particular area, the area is designated an "attainment" area. Where monitoring data do not exist for certain criteria pollutants, the designation is "unclassified." Areas that have been redesignated to attainment from nonattainment due to measured compliance with the NAAQS are designated "maintenance areas" and are subject to a 10-year maintenance plan to ensure continued compliance with the standards.

The State of Oregon Clean Air Act Implementation Plan, or State Implementation Plan (SIP), is the federally approved and enforceable plan by which Oregon identifies how it will attain and/or maintain the NAAQS. SIPs generally establish limits or work practice standards to minimize emissions of the criteria air pollutants or their precursors. Work practice standards may include best practices for fugitive dust control.

Section 176(c) of the Clean Air Act prohibits Federal entities from taking actions in maintenance areas which do not conform to the SIP for the attainment and maintenance of the NAAQS. In November 1993, EPA promulgated the General Conformity Regulations, to ensure that Federal actions other than

Table 3.11-1 Criteria pollutants

Pollutant	Characteristics	Health Effects	Major Sources
Ozone	A highly reactive, photochemical pollutant created by the action of sunshine on ozone precursors (reactive organic gases and nitrogen oxides)	• Eye irritation • Respiratory function impairment	Combustion sources, such as factories and automobiles; evaporation of solvents and fuels
Carbon Monoxide	Odorless, colorless gas that is highly toxic; formed by the incomplete combustion of fuels	• Impairment of oxygen transport in the bloodstream • Aggravation of cardiovascular disease • Fatigue, headache, dizziness	Automobile exhaust, combustion of fuels, combustion of wood in woodstoves and fireplaces
Nitrogen Dioxide	Reddish-brown gas formed during combustion	• Increased risk of acute and chronic respiratory disease	Automobile and diesel truck exhaust, industrial processes, fossil-fueled power plants
Sulfur Dioxide	Colorless gas with a pungent odor	• Increased risk of acute and chronic respiratory disease	Diesel vehicle exhaust, coal- and oil-fueled power plants, industrial processes
PM	Solid and liquid particles of dust, soot, aerosols, smoke, ash, pollen and other matter small enough to remain suspended in the air for a long period	• Aggravation of chronic disease and heart/lung disease symptoms	Dust, erosion, incinerators, automobile and aircraft exhaust, open fires

transportation actions conform to SIPs. Conformity can be demonstrated in maintenance areas by showing that emission increases are included in the SIP, increasing emission levels in the SIP (as agreed to by the state and approved by EPA), providing offsets, and/or developing mitigation measures.

Oregon's conformity rules similarly state that approval or funding of a project within, or affecting, a maintenance area is contingent on determining that it conforms to the SIP. In addition, the rules require projects to demonstrate that no new local violations will be created as a result of the project.

Projects with very low potential for air quality impact can be exempt from General Conformity regulations if it can be demonstrated that the emissions increase associated with the action for the

affected pollutant are below *de minimis* levels, that is the minimum threshold for which a conformity determination must be performed, as defined by ODEQ.

3.11.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and are potentially affected by covered activities.

Currently, there are no areas within the action area that are designated as nonattainment (ODEQ 2007b). A small portion of the Lower Sandy Watershed is within the Portland-Vancouver maintenance area for carbon monoxide. Because this project is a Federal action, in order to comply with the SIP, General Conformity regulations must be addressed. According to 40 CFR 193.53, the General Conformity *de minimis* level for carbon monoxide in a maintenance area is 100 tons per year.

3.12 Recreation

3.12.1 Regulatory Framework

Recreation activities in the Sandy River Basin occur consistently with land use designations and management activities as described in Subsection 3.2, Land Use. Much of the riparian area along the Sandy River is publicly owned. The State of Oregon, Clackamas County, City of Portland, Mt. Hood National Forest, and BLM all manage lands adjacent to the middle and lower reaches of the Sandy River. These lands are used for public parks or are protected as wild, scenic, or recreation corridors under the Wild and Scenic Rivers Act. Private ownership of riparian areas along the Sandy River and its tributaries (especially Cedar Creek) is common in the lower and middle reaches, providing additional access opportunities at property owner discretion.

Portions of the riparian area along the Sandy River that are managed by the Mt. Hood National Forest are guided by the Northwest Forest Plan (USFS 1994a) and the Mt. Hood National Forest Land and Resource Management Plan (USFS 1990), as summarized in Subsection 3.2.2.2, Land Use Plans and Policies. The Northwest Forest Plan includes many land use objectives for the protection of terrestrial and aquatic resources on Mt. Hood National Forest lands. The key goals of the Land and Resource Management Plan are to manage the forest resources to protect and maintain the character and quality of water, provide long term sustained production of water, and provide a favorable flow from the forest for both on-forest and off-forest water users.

The formal regulatory framework for recreation resources in the action area includes the Wild and Scenic Rivers Act. Congress established the national Wild and Scenic Rivers Act in 1968 to protect certain outstanding rivers from the harmful effects of new Federal projects, such as dams, hydroelectric facilities, and bridges. To be considered Wild and Scenic, a river (or river segment) must be free flowing and have at least one outstanding natural, cultural, or recreational feature.

Portions of the Sandy River became designated as Wild and Scenic through the omnibus Oregon Wild and Scenic Rivers Act of 1988, which added segments of 40 Oregon rivers to the national Wild and Scenic Rivers system. Three segments of the Sandy River were designated: the upper two segments from the river's headwaters on the west slope of Mt. Hood to the boundary of the Mt. Hood National Forest, and a third segment downstream from Dodge Park to Dabney Park. The Salmon River, from the headwaters to the confluence with the Sandy River, also is designated as a Wild and Scenic River.

These segments are managed by BLM in conjunction with private organizations, such as the Western Rivers Conservancy and The Nature Conservancy, under individual Wild and Scenic River Management Plans to provide a comprehensive approach for protecting and enhancing the free flowing natural character of the river and its associated values and natural attributes. The Upper Sandy National Wild and Scenic River Management Plan identifies general resource management objectives for recreation, which include to provide opportunities for a wide range of recreation opportunities along the river corridor managed to prevent degradation of the outstandingly remarkable values; identify, provide, and protect instream flows necessary to maintain and/or enhance the outstandingly remarkable values of the upper Sandy River; and help reduce conflicts between recreationists and private property owners and reduce trespass on private property (USFS 1994b).

3.12.2 Affected Environment

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. The following subsections describe recreational resources and the Wild and Scenic Rivers within the action area.

3.12.2.1 Recreational Resources in the Sandy River Basin

Recreational opportunities in the Sandy River Basin include fishing, boating (for this analysis, "boating" refers specifically to rafting and kayaking, but may also include canoeing and boating use by anglers), swimming, hiking, skiing, camping, picnicking, and nature study. There are numerous parks and campgrounds. Popular recreation sites and dominant recreational uses are summarized in Table 3.12-1 and shown in Figure 3.12-1.

Table 3.12-1 Dominant recreational uses of Sandy River Basin Watersheds

Watershed	Dominant Recreational Uses	Popular Recreation Sites
Upper Sandy River	Hiking, fishing, developed site and dispersed camping, cross-country skiing, nature study, sightseeing, canoeing, kayaking, drift boating, and rafting	McNeal Campground, Riley Horse Camp, and Lost Creek Campground; trails (Top Spur, Pacific Crest, Bald Mountain, Ramona Falls, Yocum Ridge, Paradise Park Loop, Zigzag Mountain, Burnt Lake, Cast Creek, Horseshoe Creek, Sandy River, and McIntyre Ridge)
Middle Sandy River	Boating, fishing, picnicking, swimming, youth camps	Dodge Park, Barlow Trail County Park, Oral Hill Picnic Area, Roslyn Lake Park, Camp Namanu
Lower Sandy River	Tube rafting, boating, fishing, picnicking, hiking, swimming, youth camps	Oxbow County Park, Dabney State Park, Lewis and Clark State Park, Camp Collins
Salmon River	Camping, hiking, snowmobiling, skiing, biking, and hunting	Trails (Old Salmon River Trail No. 742B and the lower 2 mi. of the Salmon River Trail No. 742); Timberline Lodge area, Trillium Lake and Campground, Green Canyon Campground, Wildwood Recreation site (managed by BLM), Palmer Snowfield (provides year-round skiing), Resort at the Mountain, Mt. Hood RV Village, bed and breakfast facilities, residential youth camps
Bull Run River	Fishing, swimming, kayaking below county bridge	Dodge Park (at the mouth of the river). No recreational use is permitted within the Bull Run Management Unit.
Zigzag River	Nordic and alpine skiing, camping, hiking, biking, and sightseeing	Ski areas (Timberline, Summit, and Ski Bowl [Multorpor]); National Forest campgrounds (Still Creek, Camp Creek, and Tollgate); six "organization camps"; trails (Mirror Lake, the "mountaineering trail" above Timberline Lodge, Pacific Crest Trail, Pioneer Bridle Trail, Hunchback Trail from Kinzel Lake to Devils Peak, Little Zigzag Falls Trail, Camptown and Crosstown trails, and Burnt Lake, Paradise Park, and Hidden Lake trails)

Sources: Oregon Atlas and Gazetteer 1991; USFS 1995a,b, 1996, 1997

Steelhead and salmon runs support popular sport fisheries in the Sandy River Basin. Winter steelhead is the most popular game fish. Before catch and release regulations were initiated in 1990, in-basin harvest of winter steelhead significantly affected spawning and escapement of wild winter steelhead into the upper basin. Today, hatchery winter steelhead are released at popular angling spots, such as Oxbow and Dabney Parks on the lower river. Such releases concentrate adult returns in the areas where most harvest takes place and protect the native stock from competition in important upper basin spawning and rearing areas.

The Sandy River spring Chinook salmon run historically supported a substantial sport fishery below Marmot Dam. Fall Chinook fishing in the Sandy River Basin is generally limited by natural conditions because by the time the adults return to the river to spawn, their condition and meat quality have deteriorated. Angling for trout occurs mostly in the parks of the lower and middle river and on national forest land in the upper river.

The Sandy River also supports popular whitewater recreation opportunities, particularly because of its proximity to whitewater enthusiasts from the Portland metropolitan area. Many kayakers use the lower Bull Run River, as well as the Little Sandy River. In addition, there are three designated runs on the lower Sandy River. The 7-mile stretch of the lower mainstem Sandy River from Dodge Park to Oxbow Park provides a popular and scenic run by raft or kayak that is suitable for users of all skill levels. The primary season for this run is from October through July when river flows are high (personal communication with Brian Fields, Employee, Alder Creek Kayak and Canoe, June 1, 2007).

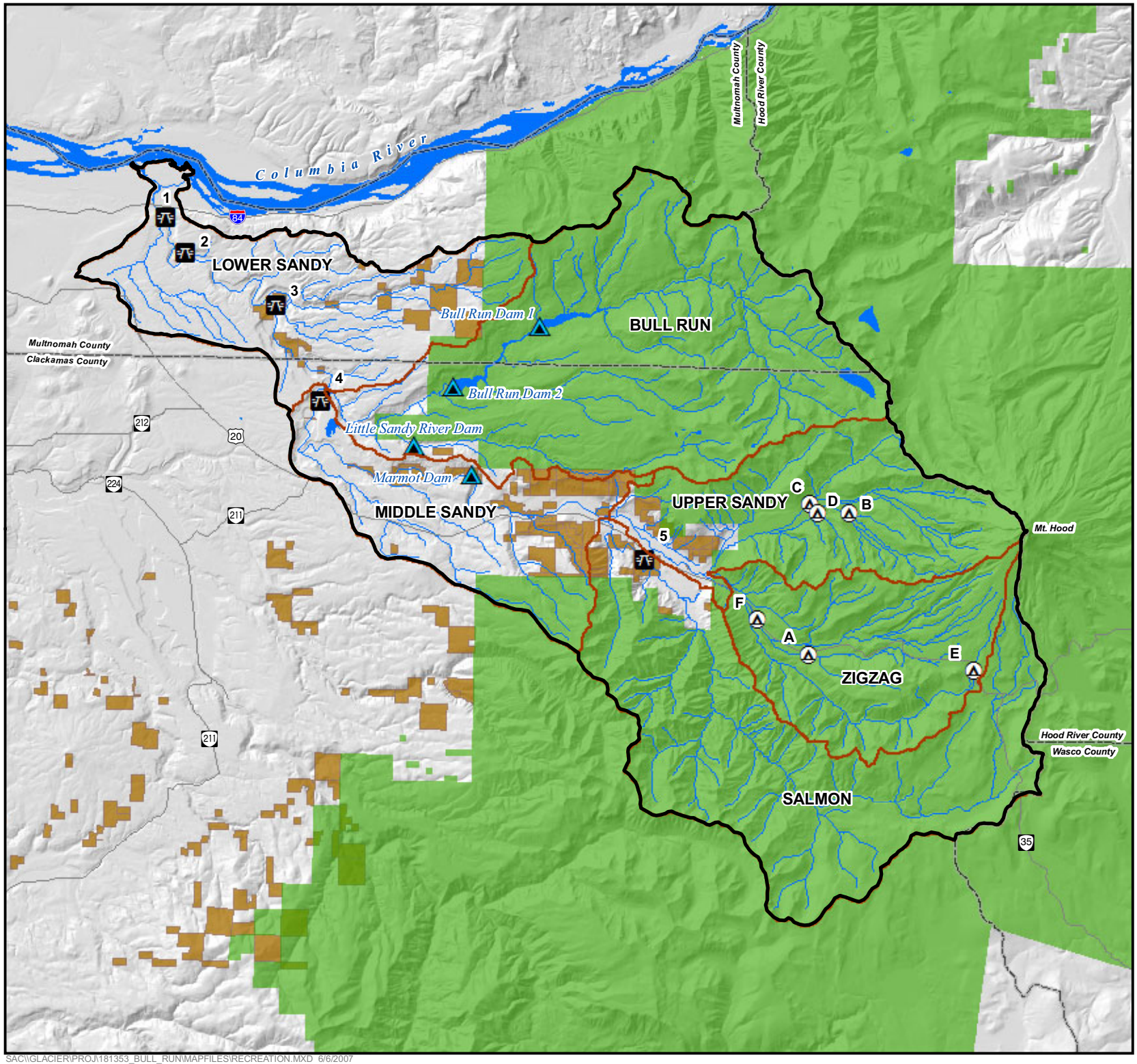
The 5-mile stretch of the lower mainstem Sandy River from Revenue Bridge to Dodge Park provides a steeper and more technically challenging ride for experienced raft or kayak users. In addition, the 6-mile stretch of the lower river from the former Marmot Dam to Revenue Bridge historically supported use by skilled kayakers. The primary season for these runs is from November through May when river flows are high.

3.12.2.2 Wild and Scenic Rivers in the Sandy River Basin

BLM and USFS manage approximately 58.4 stream miles within the Sandy River Basin that are designated as wild, scenic, or recreational under the Wild and Scenic Rivers Act. Three river segments in the basin were given various Federal Wild and Scenic River designations by Congress in 1988:

- Sandy River from Dodge Park (RM 18.5) to Dabney State Park (RM 6)(12.5 mi.) – administered by BLM, Oregon State Parks and Recreation Department, and Multnomah and Clackamas Counties
- Sandy River from the headwaters to the Mt. Hood National Forest boundary (12.4 mi.) – administered by USFS
- Salmon River from the headwaters to the confluence with the Sandy River (33.5 mi.) – administered by USFS and BLM

These designations and their meaning under the Wild and Scenic Act are pertinent to fish production and habitat within the basin because fisheries are identified as an outstandingly remarkable value



Key Boundaries

- Dam Locations
- Creeks and Streams
- Lakes and Reservoirs
- Sandy River Basin
- Sandy River Basin Watersheds
- Mt Hood National Forest
- Bureau of Land Management

Parks

1. Lewis and Clark State Park
2. Dabney State Park
3. Oxbow County Park
4. Dodge Park
5. Wildwood Recreation Area

Campgrounds

- A - Camp Creek Campground
- B - Lost Creek Campground
- C - McNeil Campground
- D - Riley Campground
- E - Still Creek Campground
- F - Tollgate Campground

Projection:
State Plane Oregon North Feet
North American Datum 1983

N

0 2.5 5 Miles

0 4,023 8,046 Meters

Scale = 1:316,800

Sources: City of Portland, 2007;
The Oregon Geospatial Enterprise Office, 2007;
CH2M HILL, 2007.

Figure 3.12-1
Recreation Features
Bull Run HCP EIS

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(ORV) for each of the reaches designated, and the Act mandates managing agencies to develop measures to protect and/or enhance the ORVs associated with the designated river and associated corridor.

The ORVs for the river segments specified above include the following:

- Sandy River from Dodge Park to Dabney State Park: scenery, fisheries, recreation, geology, wildlife, water quality, botanical and ecological, and cultural
- Sandy River from the headwaters to the Mt. Hood National Forest boundary: scenery, recreation, fisheries, geology, and botany
- Salmon River from the headwaters to the confluence with the Sandy River: scenery, recreation, water quality, botanical, ecological, wildlife, and fisheries